Customizing the ArcGIS Desktop

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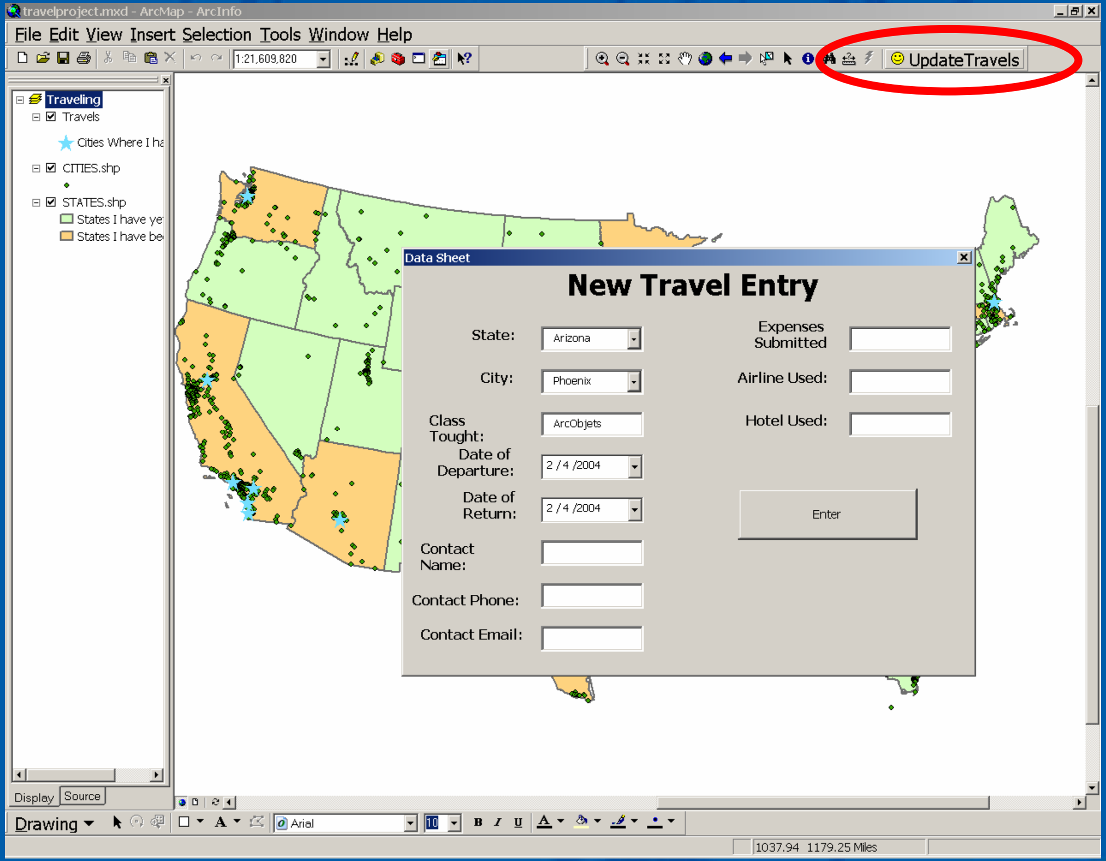
ESRI Denver

AGIC 2005 Conference

Prescott, AZ

VBA Customization

- Customize the interface to suite your needs without writing code
- Use VBA to extend ArcMap/ArcCatalog
- Create custom user forms, buttons and tools
- Automate workflows
- *Subject of this seminar*



Data Sheet

New Travel Entry

State: Arizona

City: Phoenix

Class Tought: ArcObjets

Date of Departure: 2 /4 /2004

Date of Return: 2 /4 /2004

Contact Name:

Contact Phone:

Contact Email:

Expenses Submitted

Airline Used:

Hotel Used:

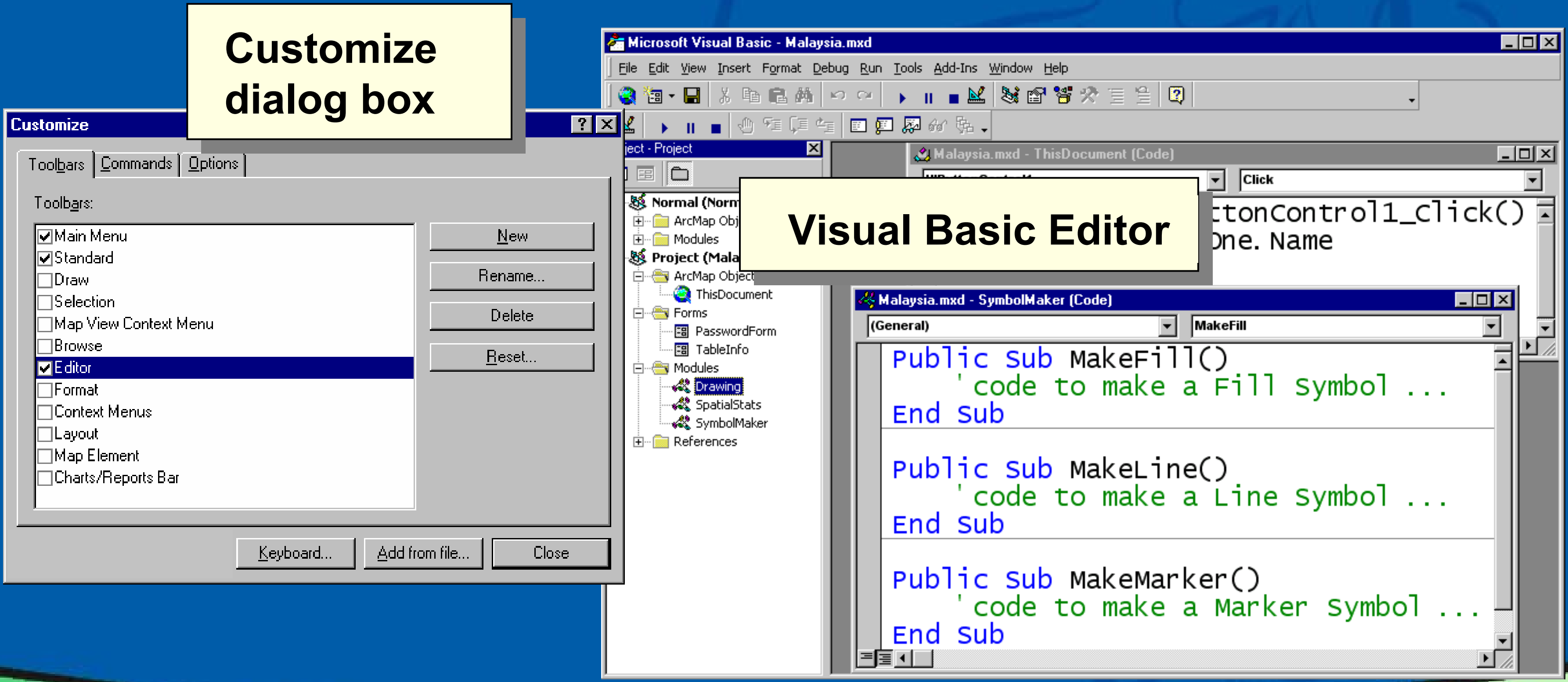
Enter

Workshop overview

- The VBA development environment
  - – Customize dialog box
    - Changing the UI without writing code!
  - – Visual Basic Editor
    - Where to write code
- Using developer samples
- Introductory look at ArcObjects (if time allows)
- Questions

The VBA development environment

- Similar environment for all applications that use VBA
  - Customize dialog box: Interface customization
  - Visual Basic Editor: Writing code



Customize dialog box

Visual Basic Editor

Toolbars:

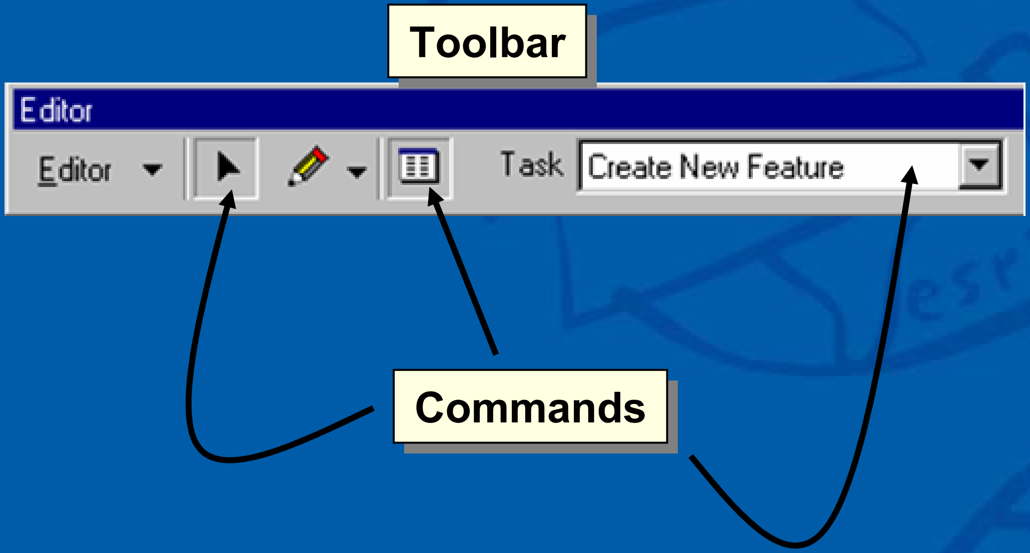
☑ Main Menu
☑ Standard
□ Draw
□ Selection
□ Map View Context Menu
□ Browse
☑ Editor
□ Format
□ Context Menus
□ Layout
□ Map Element
□ Charts/Reports Bar

```
ttonControl1_Click()
One. Name
```

```
Public Sub MakeFill()
    'code to make a Fill Symbol ...
End Sub

Public Sub MakeLine()
    'code to make a Line Symbol ...
End Sub

Public Sub MakeMarker()
    'code to make a Marker Symbol ...
End Sub
```

ArcGIS commands

- Toolbars and menus contain *commands*
- Commands are buttons, menus, macros, and UIControls
- Each command has associated code



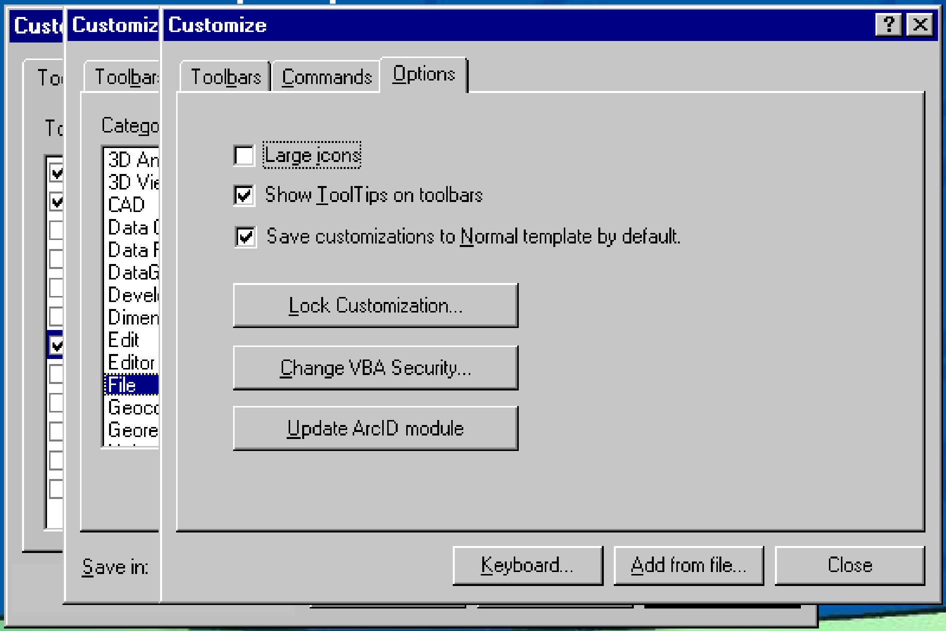
Toolbar

Task Create New Feature

Commands

Using the Customize dialog box

- Open the dialog to put the interface in *design mode*
- With the Customize dialog box open, you can …
  - Rearrange or remove existing commands
  - Add new toolbars and commands
  - Change command properties



Customize

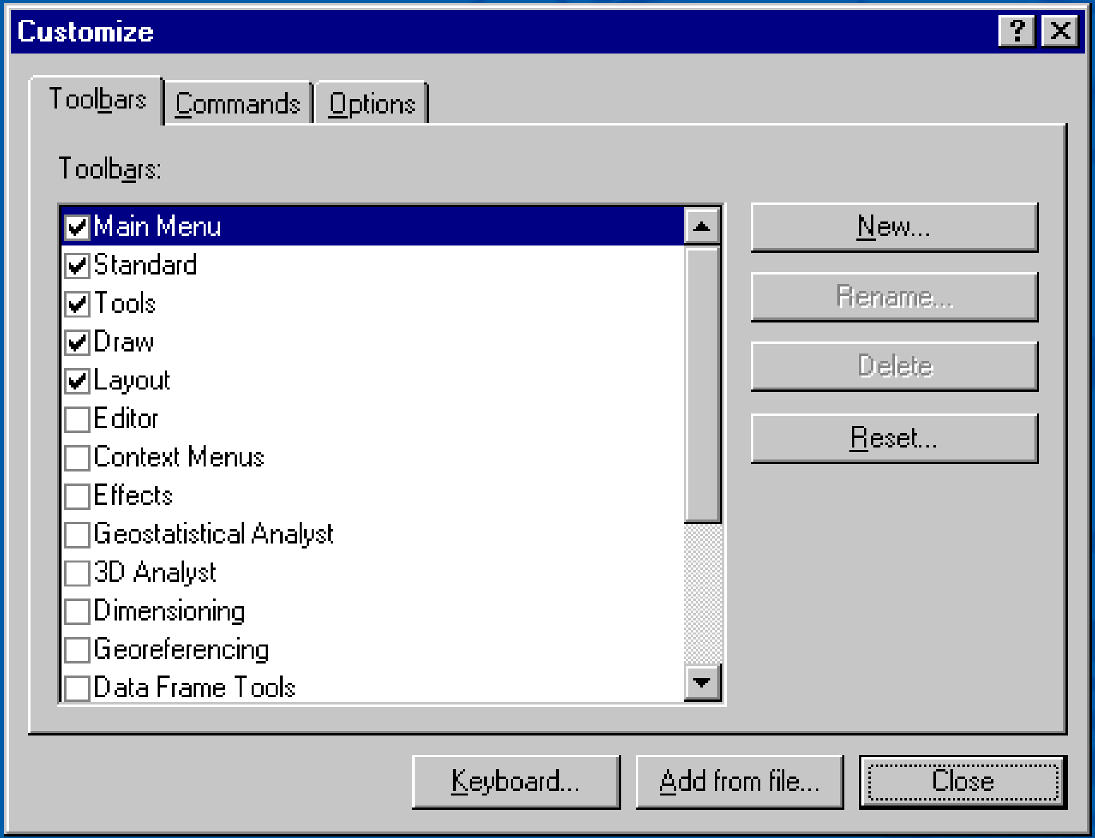
☐ Large icons

☑ Show ToolTips on toolbars

☑ Save customizations to Normal template by default.

The Customize Dialog

- Toolbars tab
  - Turn toolbars on and off, create new

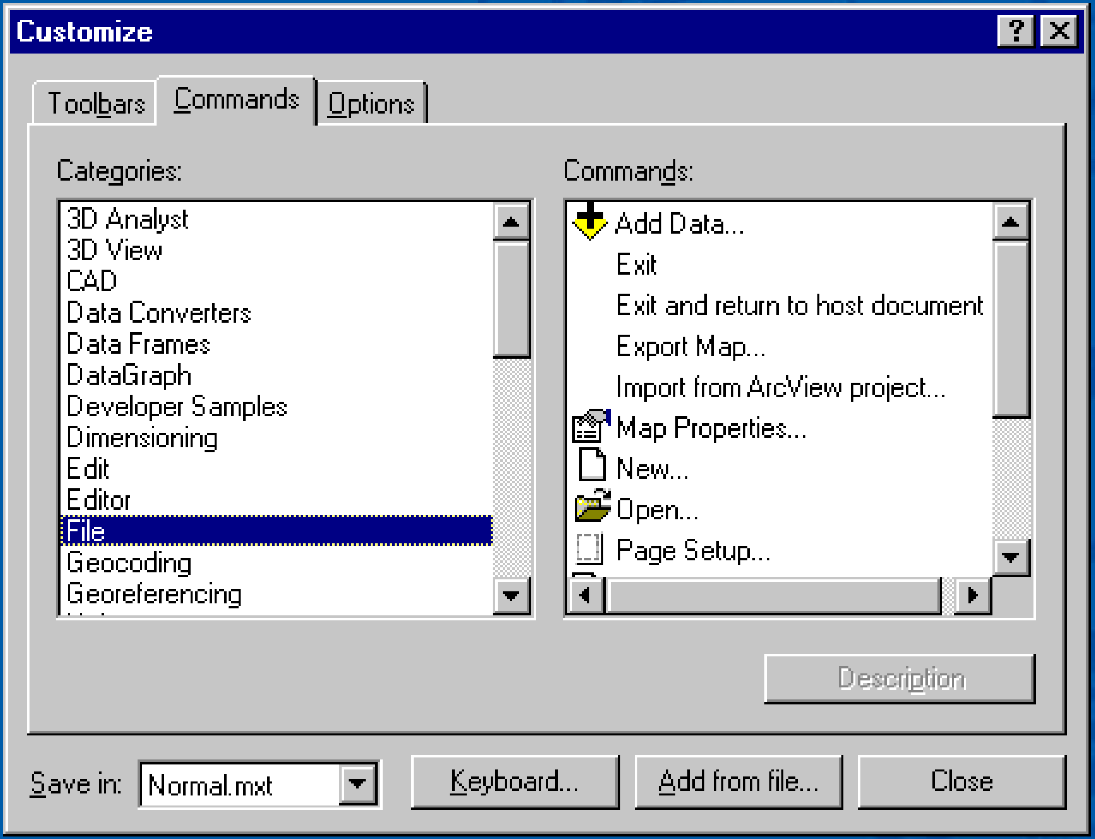


Toolbars:

☑ Main Menu
☑ Standard
☑ Tools
☑ Draw
☑ Layout
□ Editor
□ Context Menus
□ Effects
□ Geostatistical Analyst
□ 3D Analyst
□ Dimensioning
□ Georeferencing
□ Data Frame Tools

The Customize Dialog

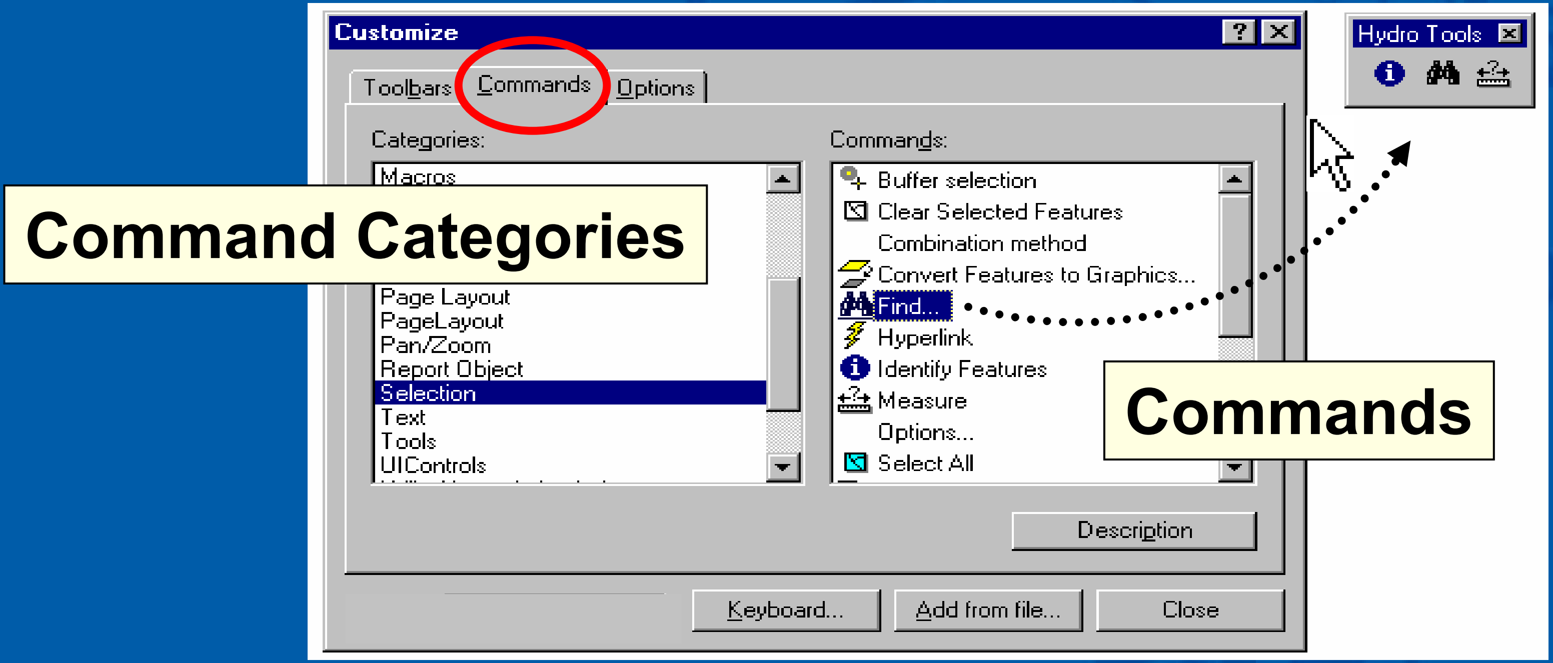
- Command tab
  - Drag and drop commands to existing toolabars



Save in: Normal.mxt

Using the Customize dialog box

- Commands are organized into categories
- All ArcMap or ArcCatalog commands are here
  - Some that are not on the interface by default
- Drag commands onto toolbars *or* menus

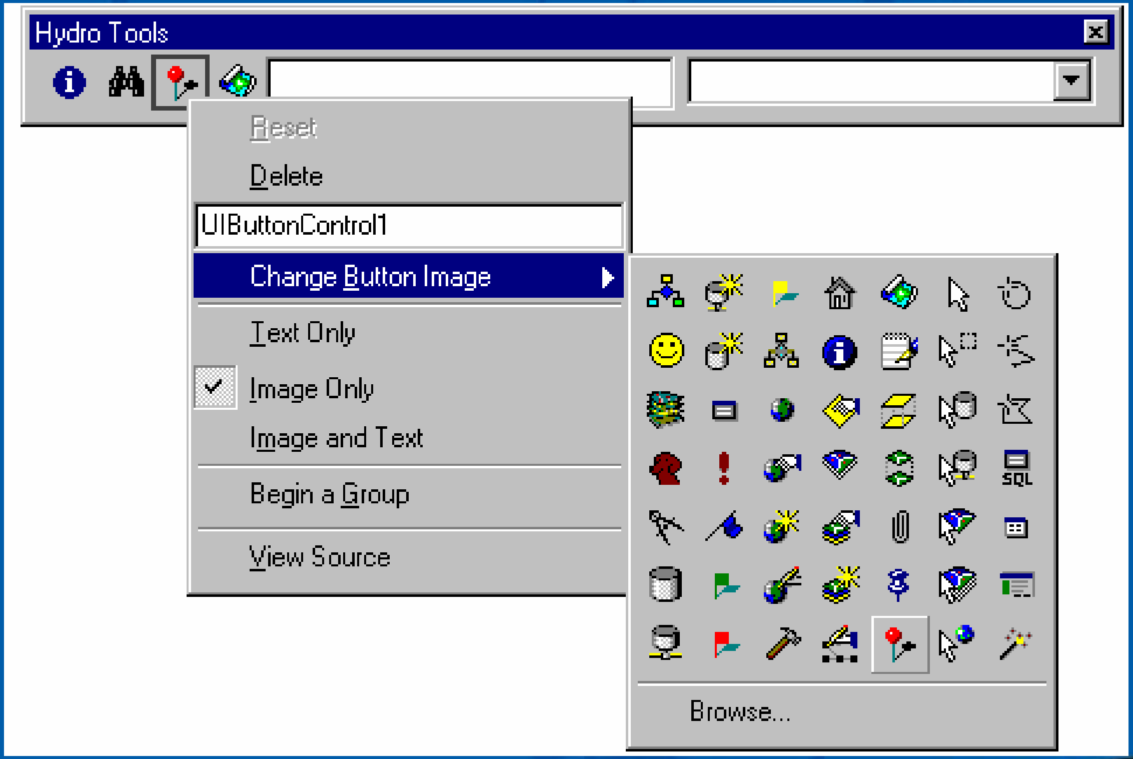


Command Categories

Commands

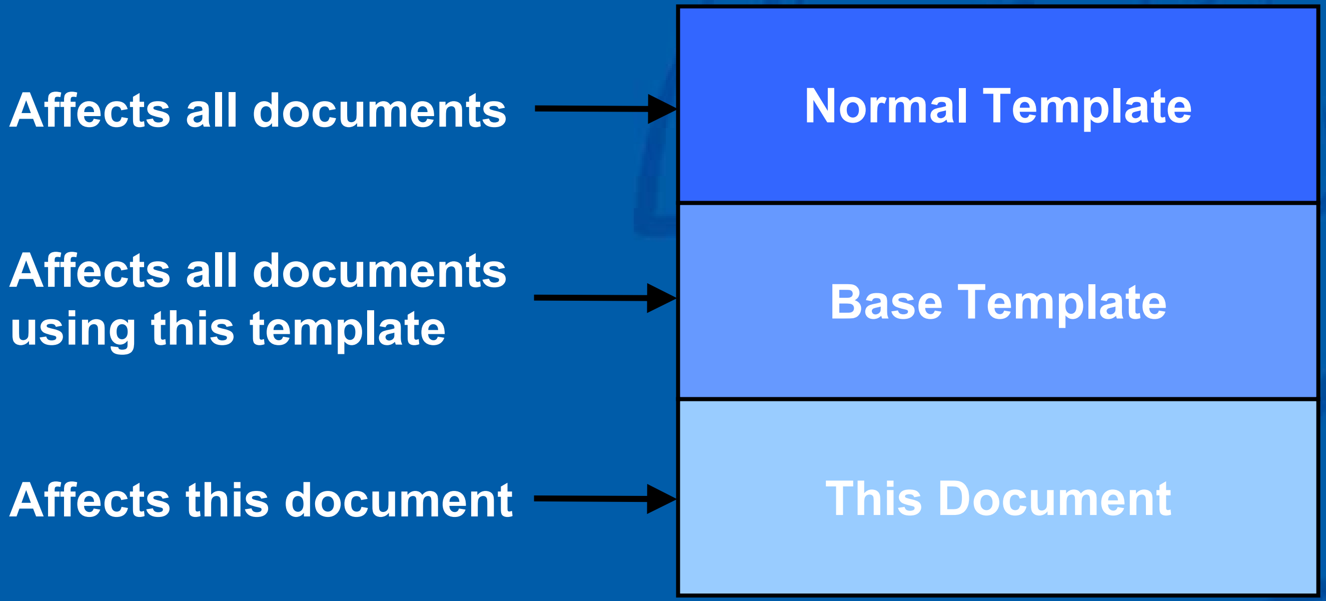
Setting control properties

- Customize dialog box must be open
- Right-click a control to view and change properties
- Characteristics that define appearance
  - Name
  - Image
  - Display text or image
  - Begin a group



Accessing your customizations

- ArcMap has three levels of storage
- Templates are read in order on startup



Affects all documents → Normal Template

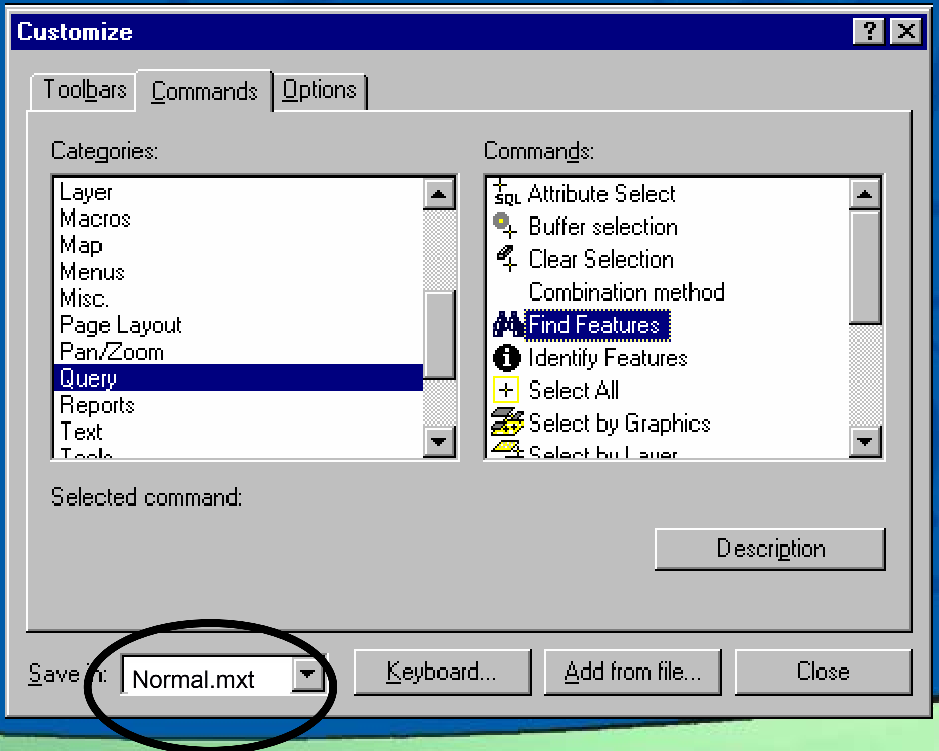
Affects all documents using this template → Base Template

Affects this document → This Document

- ArcCatalog only uses the Normal template

Storing your customizations

- All customizations are saved
  - Normal template, Base template, or the current document
- Current map overrides any templates
  - For example, controls can be added or removed



Save in: →

Customize

Toolbars | Commands | Options

Categories:

- Layer
- Macros
- Map
- Menus
- Misc.
- Page Layout
- Pan/Zoom
- Query
- Reports
- Text
- Tools

Commands:

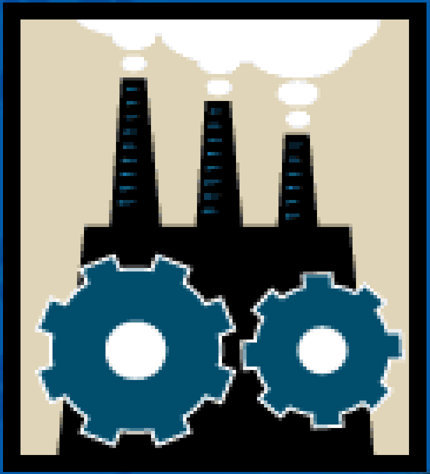
- Attribute Select
- Buffer selection
- Clear Selection
- Combination method
- Find Features
- Identify Features
- Select All
- Select by Graphics
- Select by Layer

Selected command:

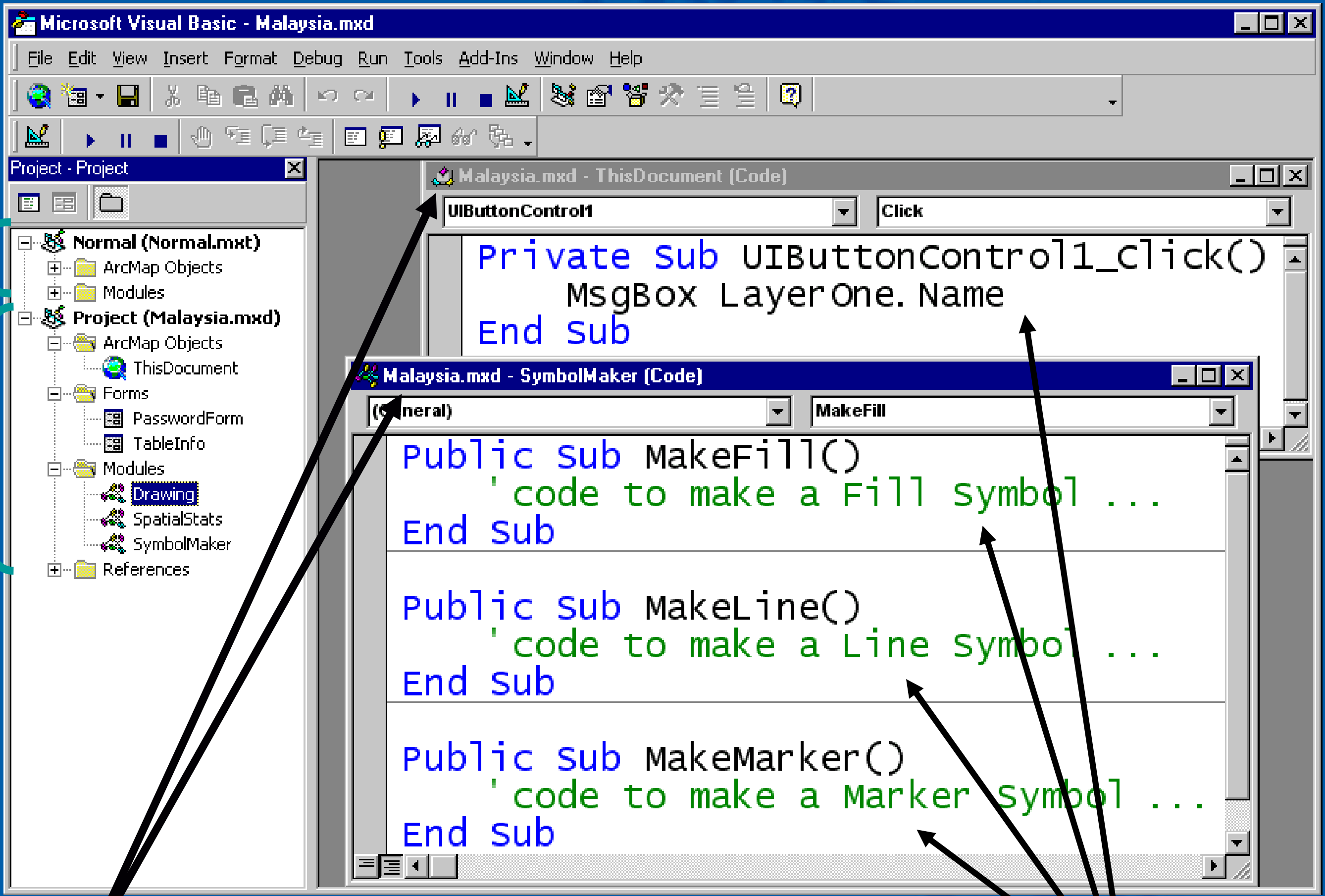
Save in: Normal.mxt

Instructor Led Demo

- Using the Customize dialog box to …
  - – Rearrange interface commands
  - – Create a new toolbar
  - – Add existing commands to the interface
  - – Create a new UIControl
  - – Change command properties
  - – Reset a toolbar to its original appearance



The Visual Basic Editor



```
Private Sub UIButtonControl1_Click()
    MsgBox LayerOne.Name
End Sub
```

```
Public Sub MakeFill()
    'code to make a Fill Symbol ...
End Sub

Public Sub MakeLine()
    'code to make a Line Symbol ...
End Sub

Public Sub MakeMarker()
    'code to make a Marker Symbol ...
End Sub
```

Project Explorer

Projects

Code Modules

Procedures

Understanding ArcMap software's code storage

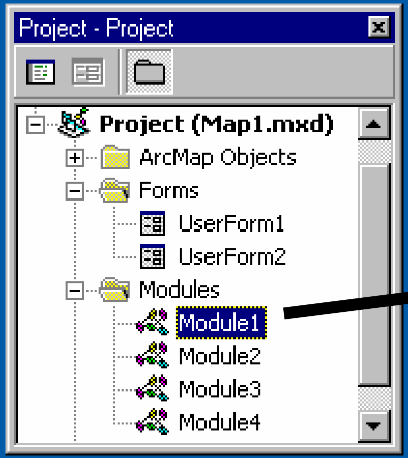
Project Explorer: Organizes *projects* (levels of customization)

Contains → Project: Folder that stores *modules* (e.g., Normal.mxt)

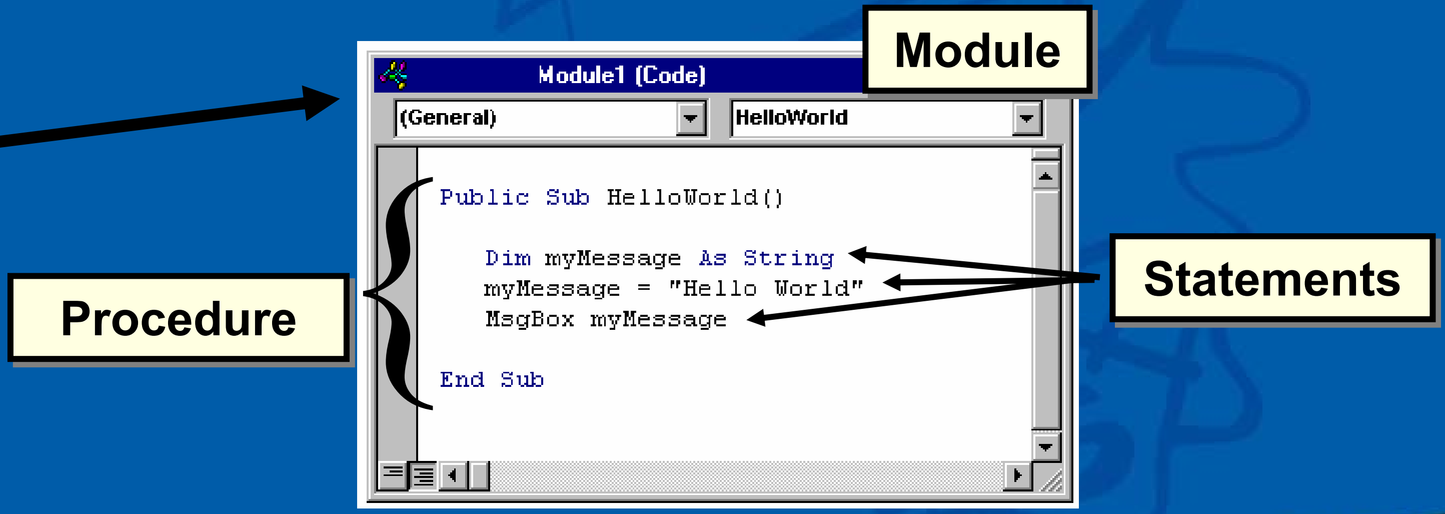
Contains → Module: Document that stores code

Contains → Procedure: A block of code (e.g., macros)

Contains → Statement: A line of code



```
Project - Project
⊟ Project (Map1.mxd)
   ⊞ ArcMap Objects
   ⊟ Forms
        UserForm1
        UserForm2
   ⊟ Modules
        Module1
        Module2
        Module3
        Module4
```



Module1 (Code)

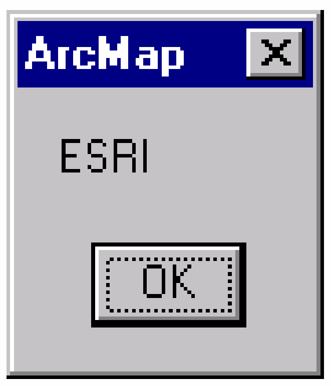
(General) | HelloWorld

```
Public Sub HelloWorld()

   Dim myMessage As String
   myMessage = "Hello World"
   MsgBox myMessage

End Sub
```

Writing Visual Basic statements

- Carry out actions
- Written inside procedures
- May have arguments
  - Multiple arguments are separated with commas
  - Some arguments are optional

```
Private Sub ShowMsgBox()
  Beep
  MsgBox "ESRI"
End Sub
```

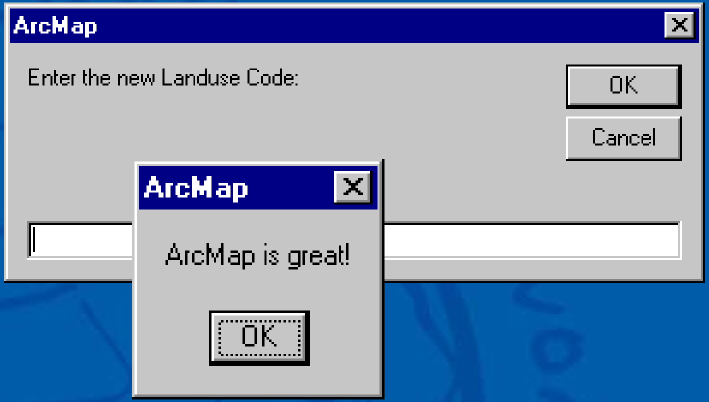


ESRI

Some common Visual Basic functions

- InputBox to get information

```
InputBox "Enter the new Landuse Code: "
```



ArcMap

Enter the new Landuse Code:

ArcMap

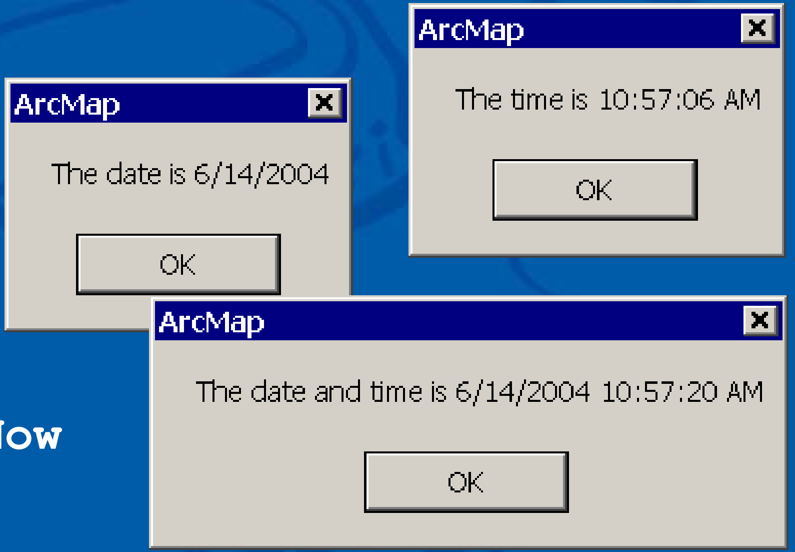
ArcMap is great!

- *MsgBox* to report a message

```
MsgBox "ArcMap is Great!"
```

- Combine (concatenate) strings with & …
- Get the *Date* or *Time* …

```
MsgBox "The date is " & Date

MsgBox "The time is " & Time

MsgBox "The date and time is " & Now
```



ArcMap

The time is 10:57:06 AM

ArcMap

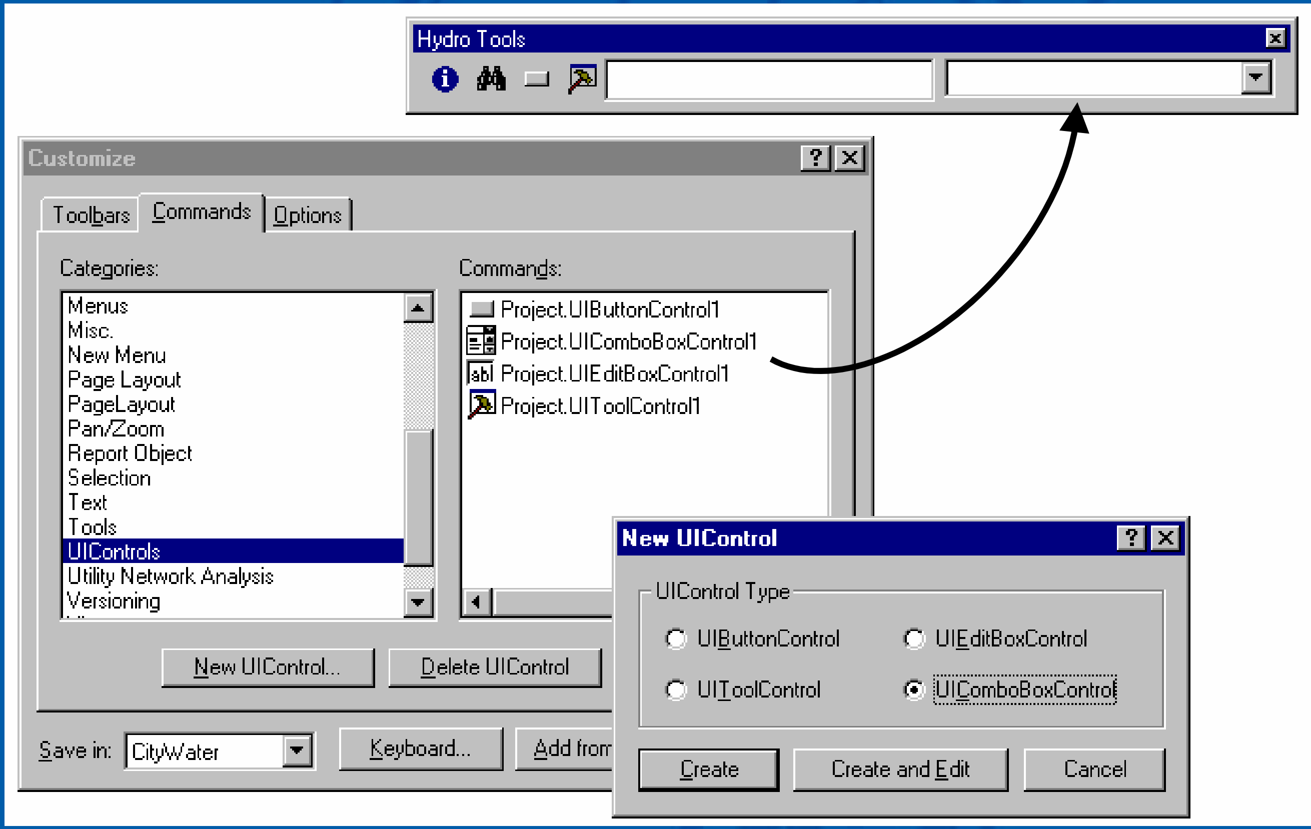
The date is 6/14/2004

ArcMap

The date and time is 6/14/2004 10:57:20 AM

Creating a new command

- *UIControls* category
  - User-created commands
- Four types
  - Button
  - Tool
  - EditBox
  - ComboBox

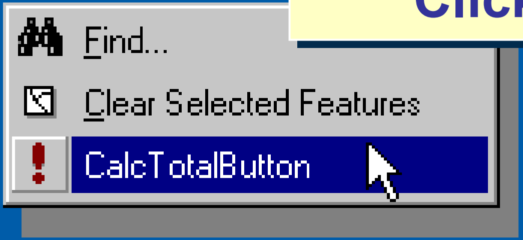


Save in: CityWater

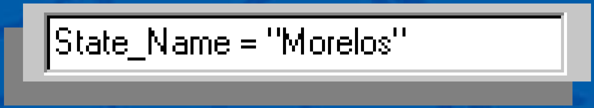
UIControl Type: ● UIComboBoxControl

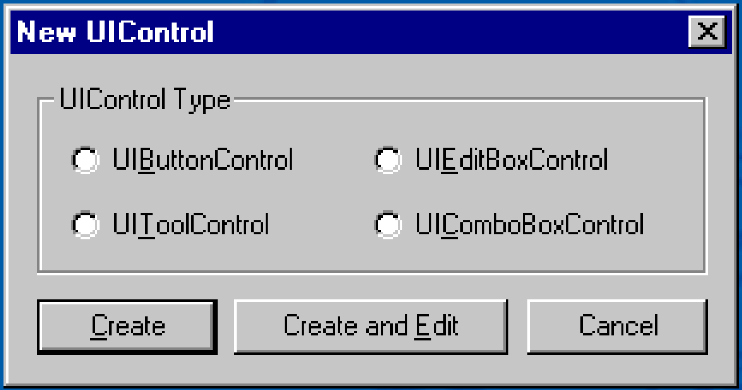
Event Procedures

Click

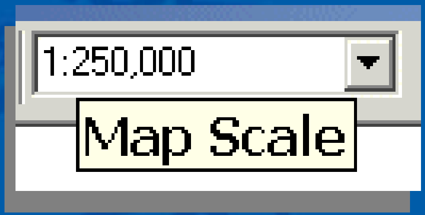


Change

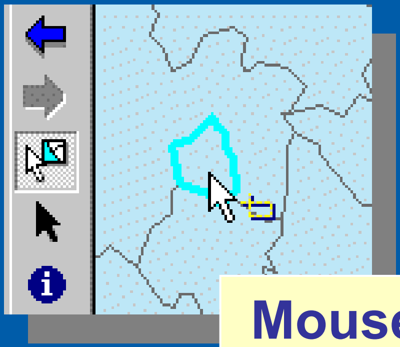

State_Name = "Morelos"



ToolTip

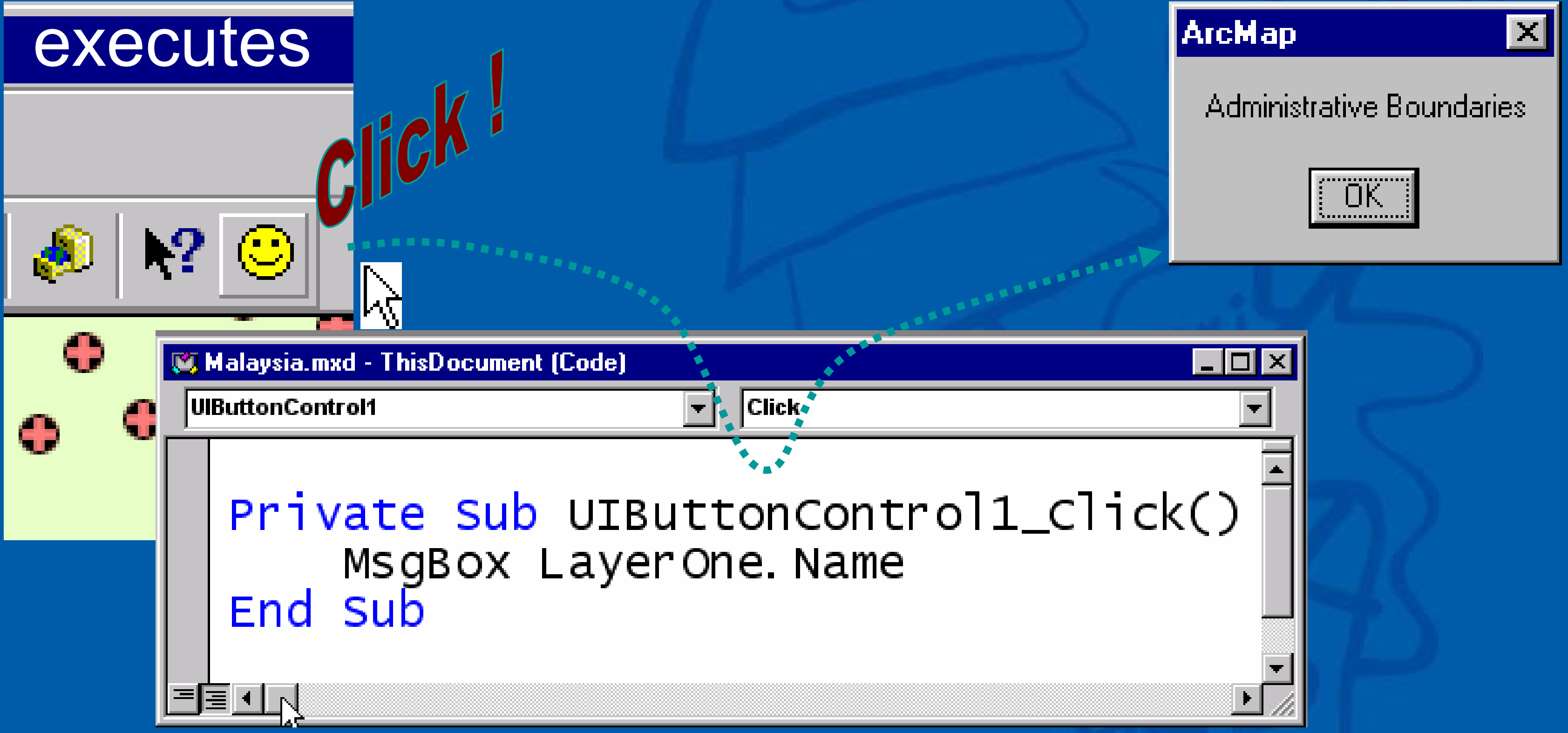

1:250,000

MouseDown



Running an event procedure

- Controls have a predefined set of events
  - You choose which ones to code
- When an event is *fired,* the associated code executes



Malaysia.mxd - ThisDocument (Code)

UIButtonControl1 | Click

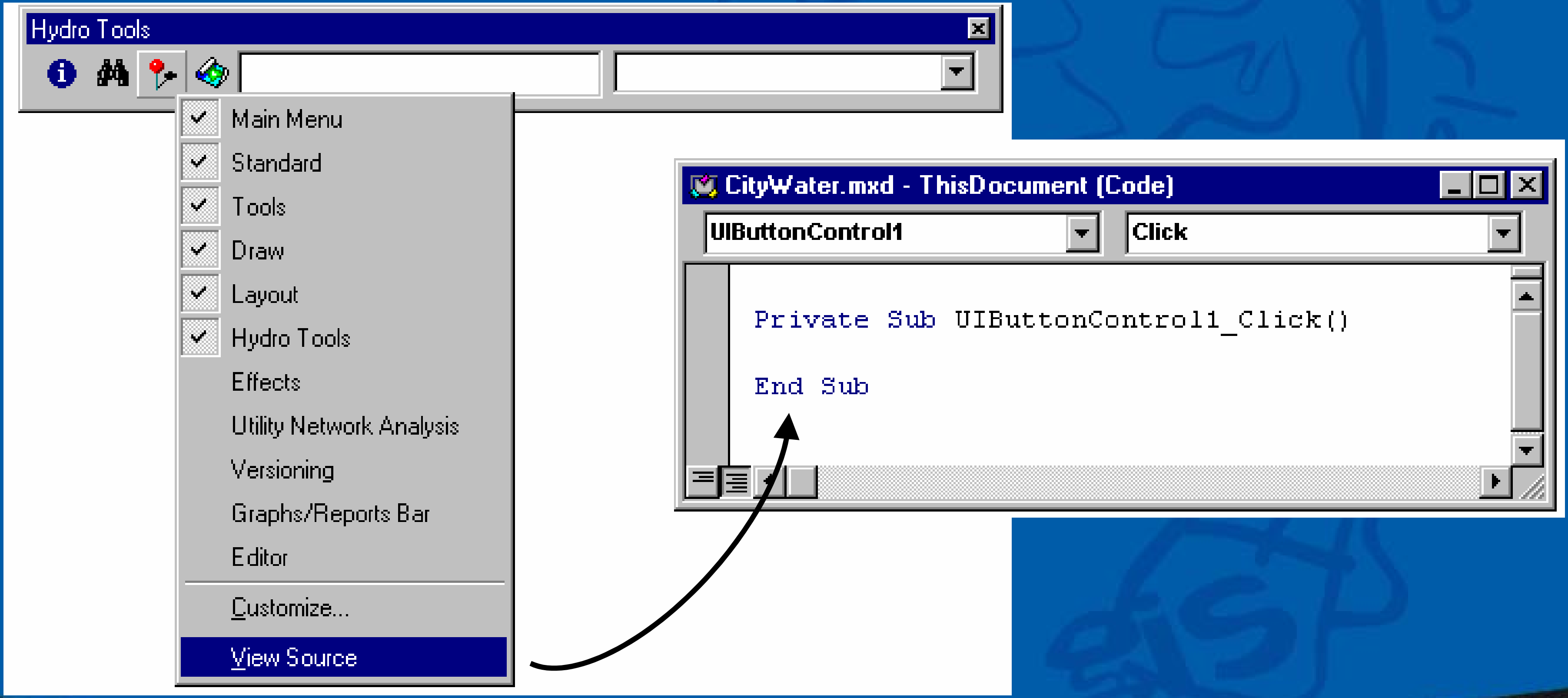
```
Private Sub UIButtonControl1_Click()
    MsgBox LayerOne.Name
End Sub
```

ArcMap

Administrative Boundaries

Examining a control's source code

- Commands have *events* (e.g., Click, Double-click, MouseUp, KeyDown, KeyUp)
- Code runs when its corresponding event occurs



CityWater.mxd - ThisDocument (Code)

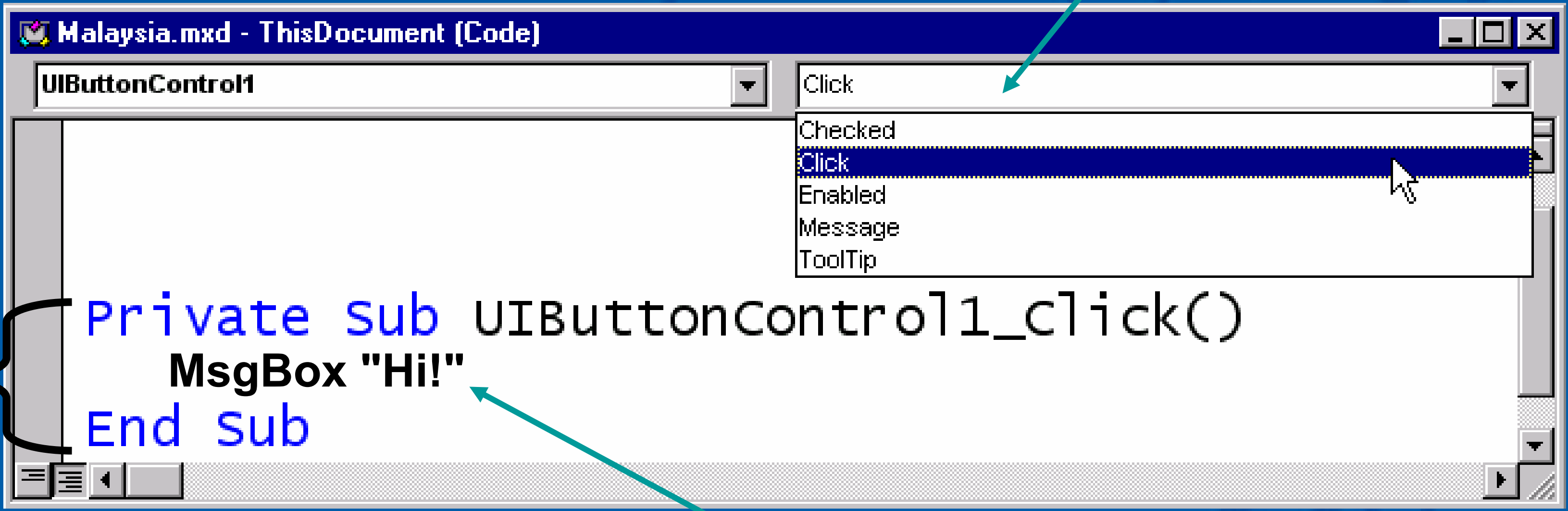
UIButtonControl1 | Click

```
Private Sub UIButtonControl1_Click()

End Sub
```

Navigating event procedures in a module

- **Choose an event in the *Procedure* box**

Procedure box



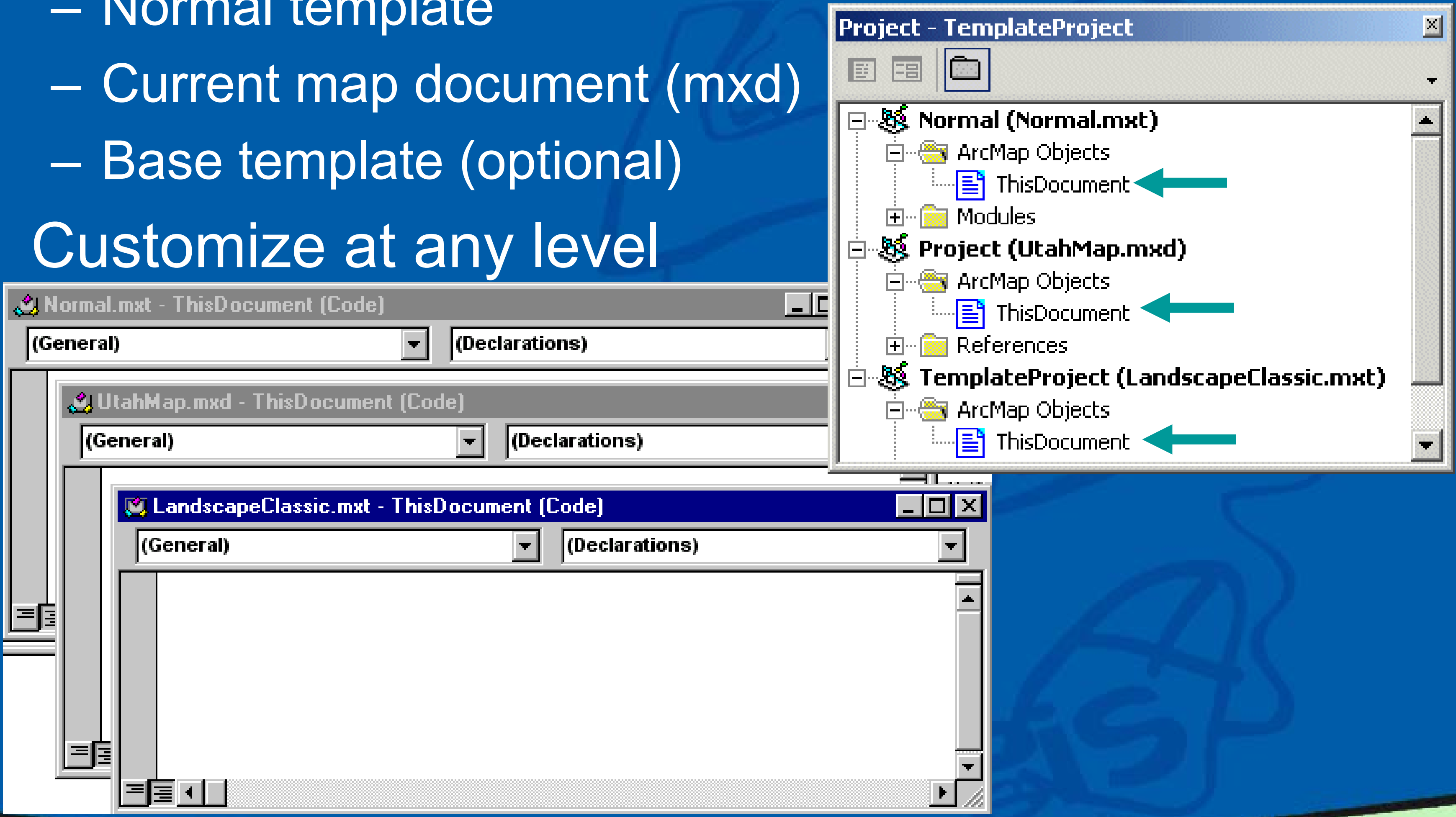
```
Private Sub UIButtonControl1_Click()
    MsgBox "Hi!"
End Sub
```

Wrapper lines are added automatically

Write code to run when UIButtonControl1 is clicked

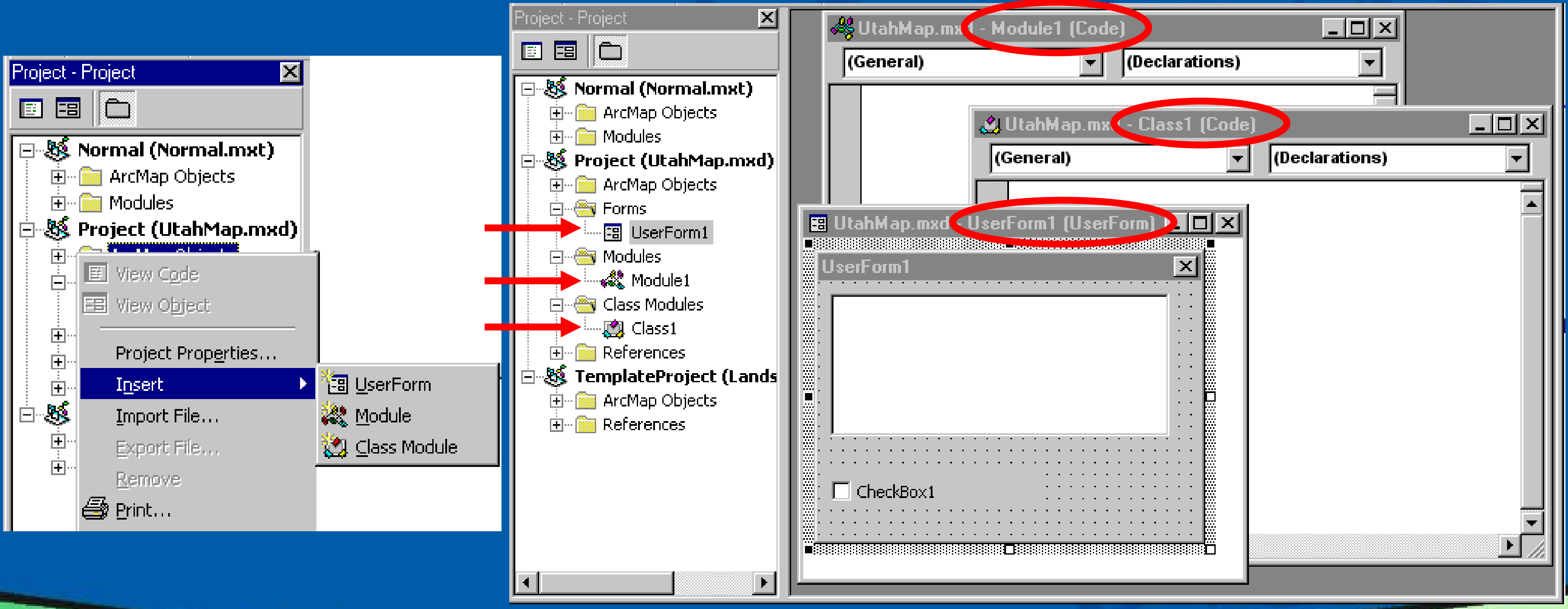
The *ThisDocument* module

- Contains code associated with a document
  - Normal template
  - Current map document (mxd)
  - Base template (optional)
- Customize at any level



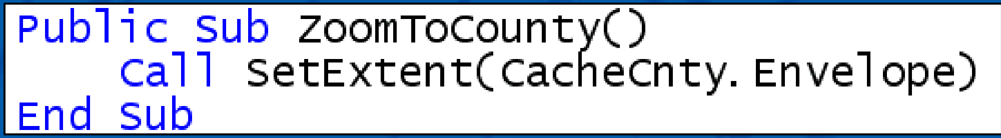
Creating a new module

- Module (standard module): Contains *standalone* code
- Class module: Contains a class definition
- UserForm: Contains code and layout for a form

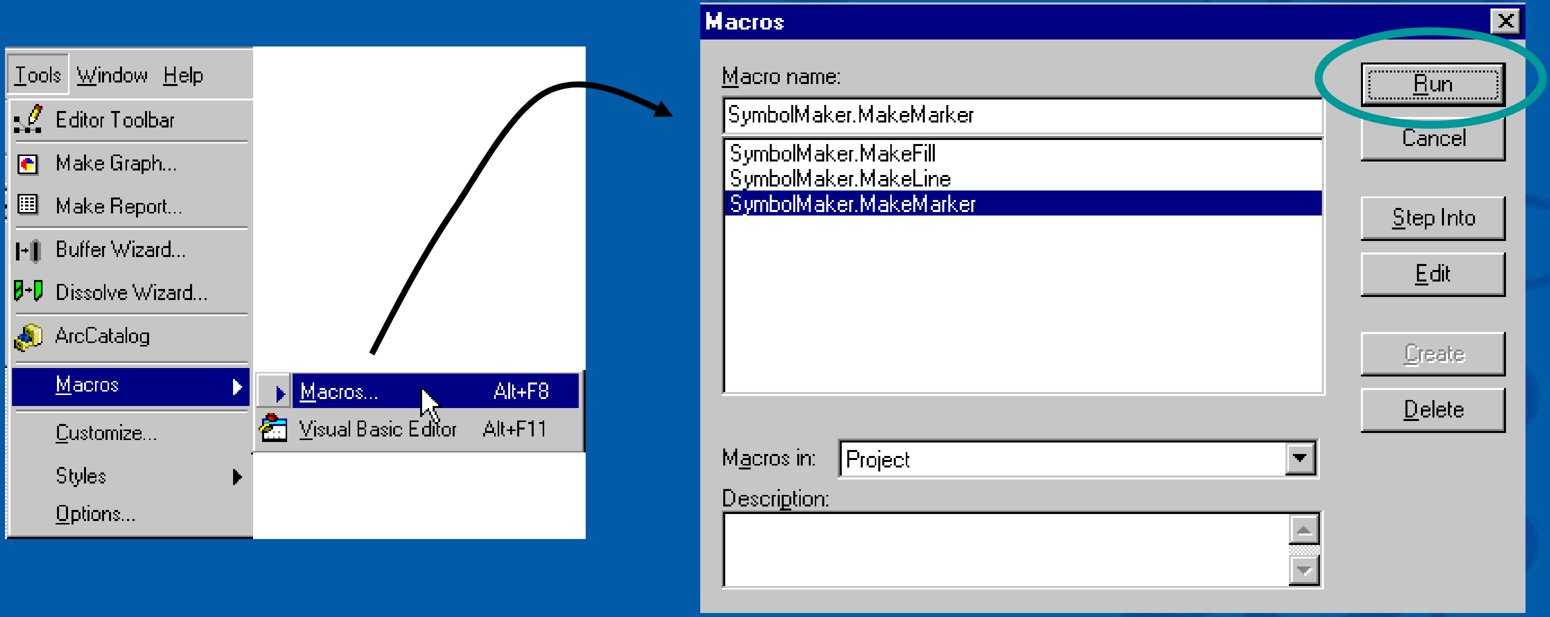


Running a subroutine or function procedure

- No event to cause code execution
- Must call the procedure
  - Macro menu: Interface
  - Call statement: Code



```
Public Sub ZoomToCounty()
    Call SetExtent(CacheCnty.Envelope)
End Sub
```



Macro name: SymbolMaker.MakeMarker

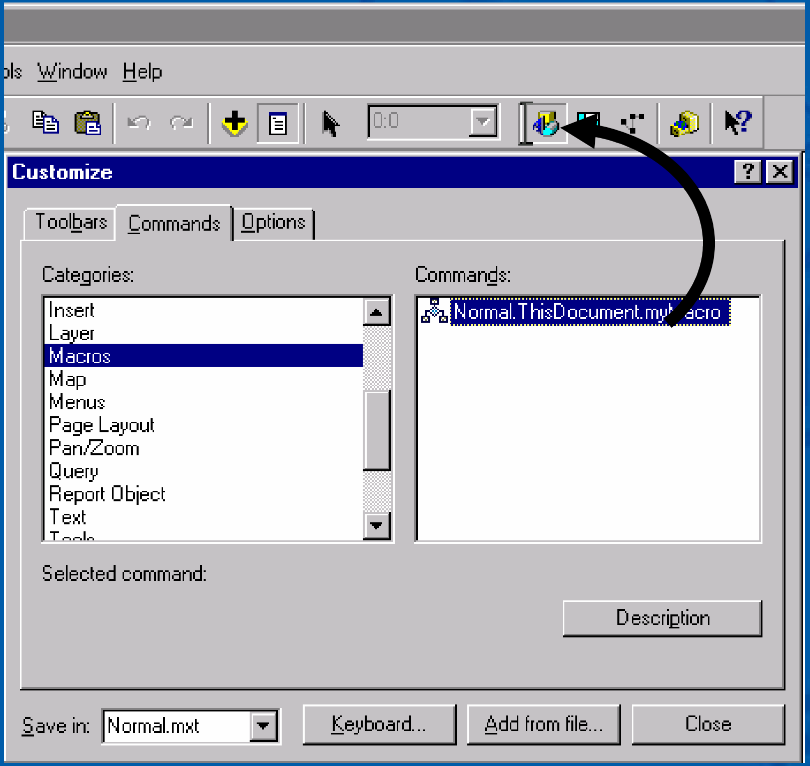
SymbolMaker.MakeFill
SymbolMaker.MakeLine
SymbolMaker.MakeMarker

Macros in: Project

Description:

Adding a macro to a toolbar

- Macros category of the Customize dialog
- Macro becomes a button on the toolbar
  - Edit the control's properties



Categories:
- Insert
- Layer
- Macros
- Map
- Menus
- Page Layout
- Pan/Zoom
- Query
- Report Object
- Text
- Tools

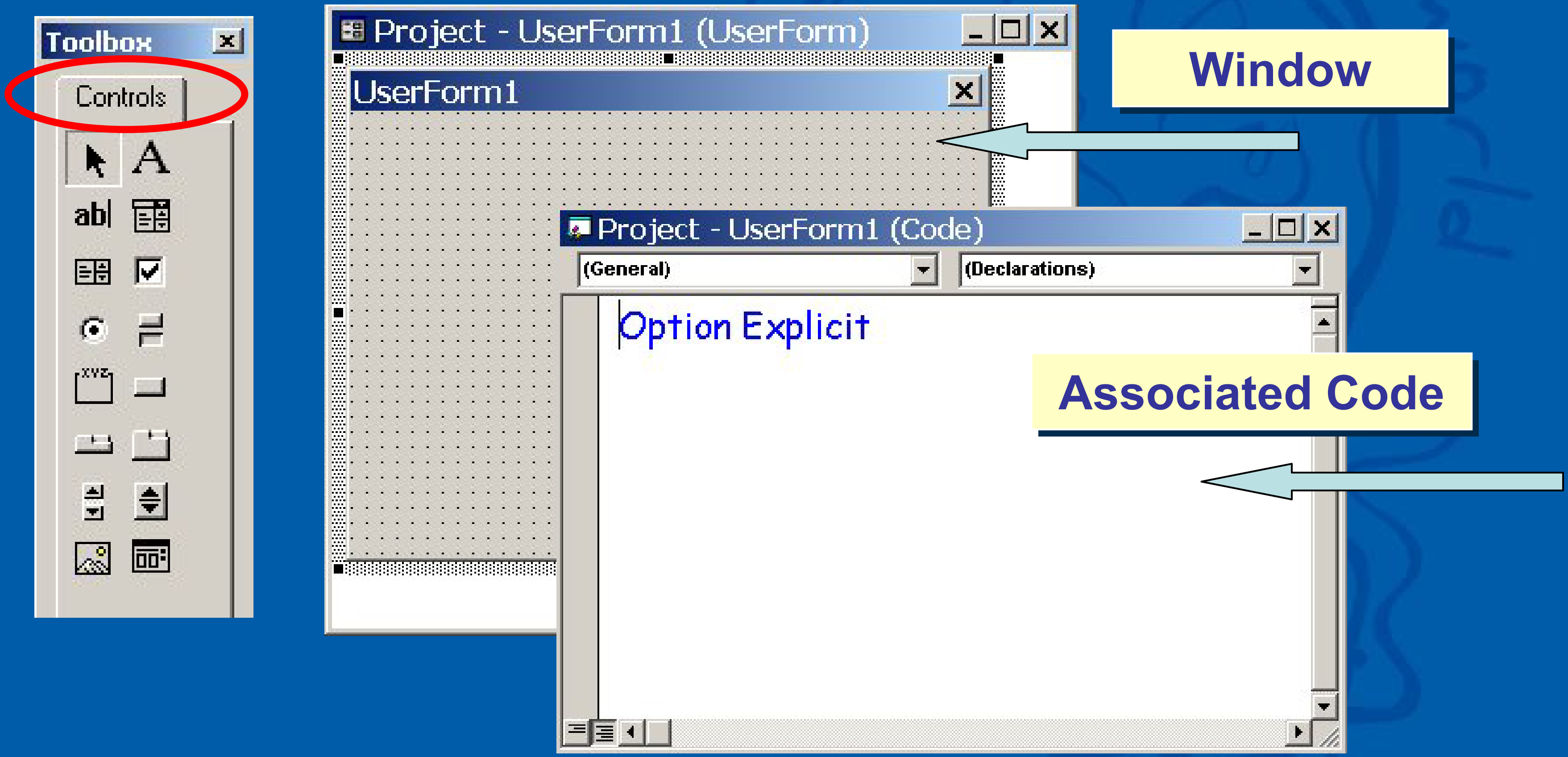
Commands:
Normal.ThisDocument.myMacro

Selected command:

Save in: Normal.mxt

What is a Form?

- It’s a module
- Window of controls + associated code



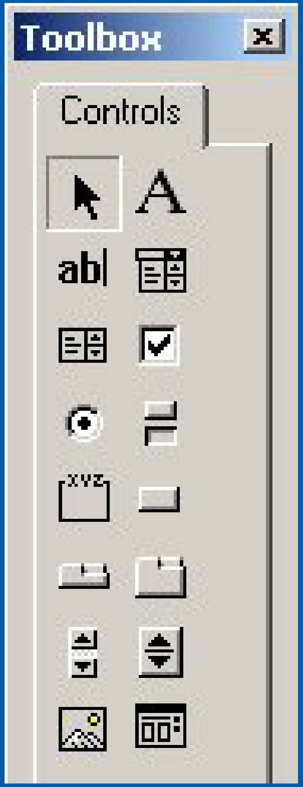
```
Option Explicit
```

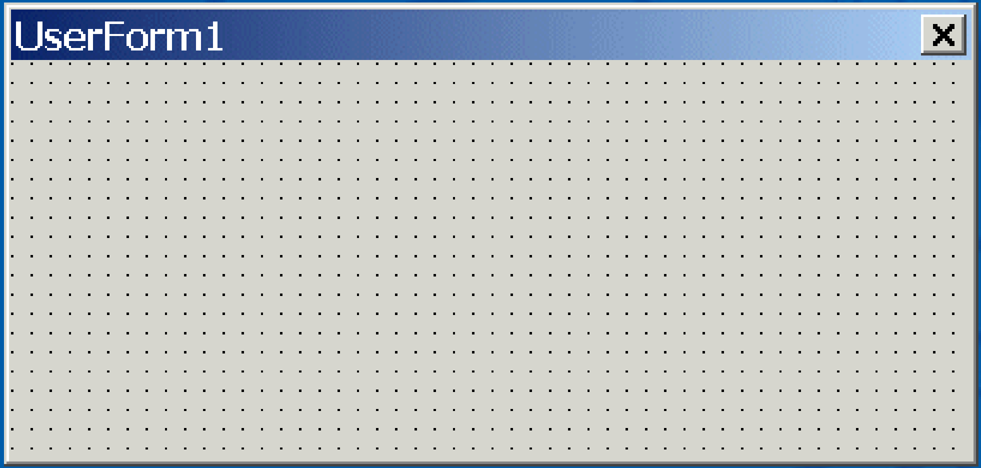
Window

Associated Code

Placing Controls on the Form

- Click and drag – from toolbox to window
- Given default properties





Placing Controls on the Form

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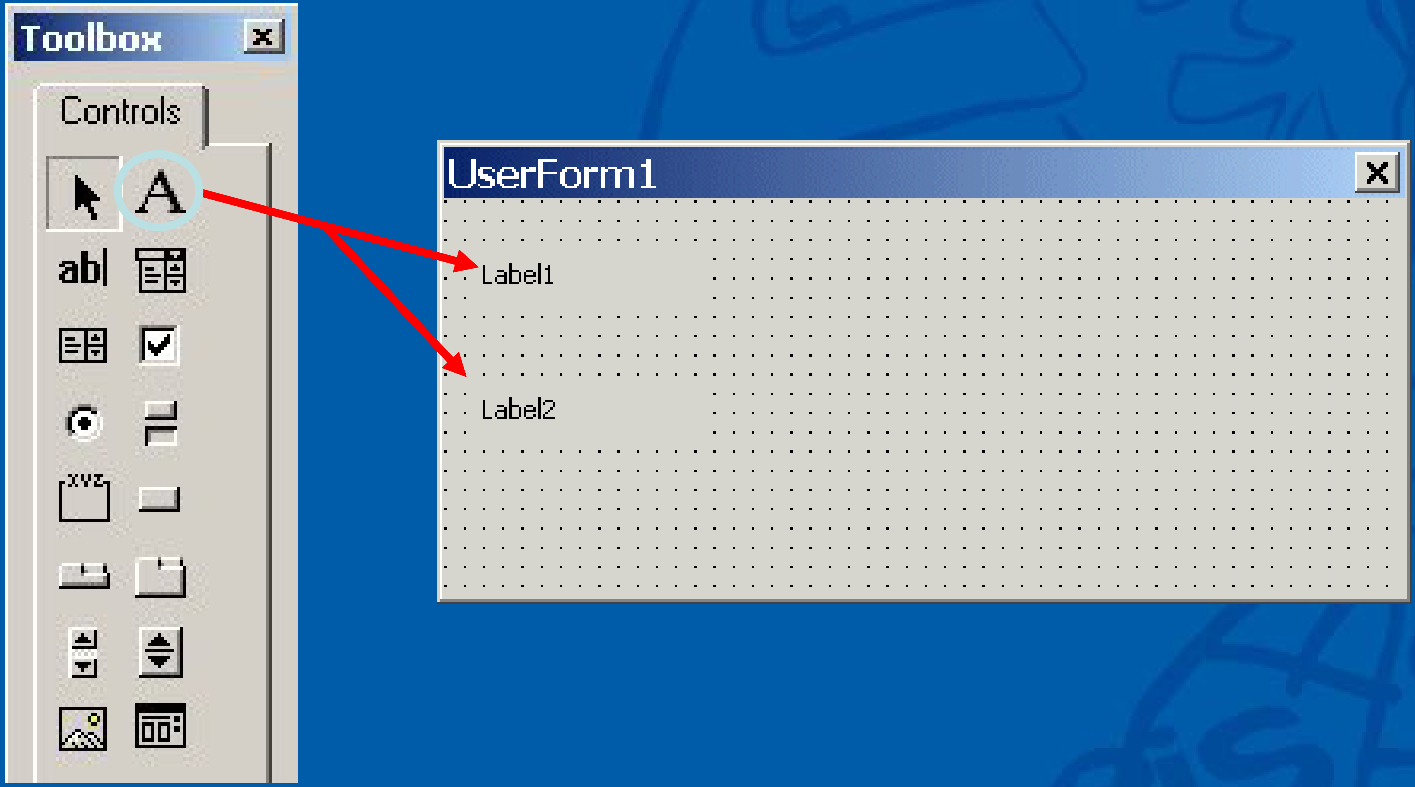
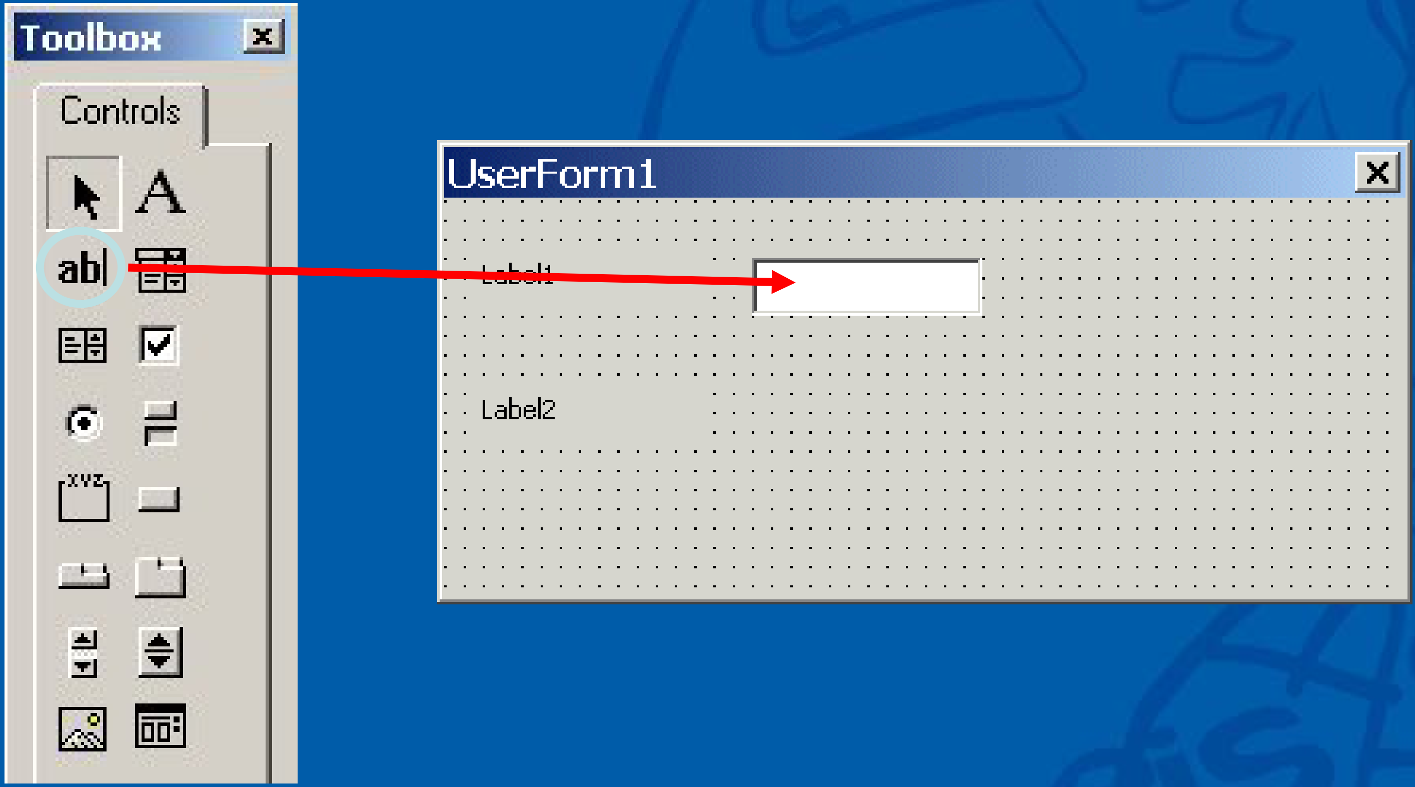


Placing Controls on the Form

- Click and drag – from toolbox to window
- Given default properties



Placing Controls on the Form

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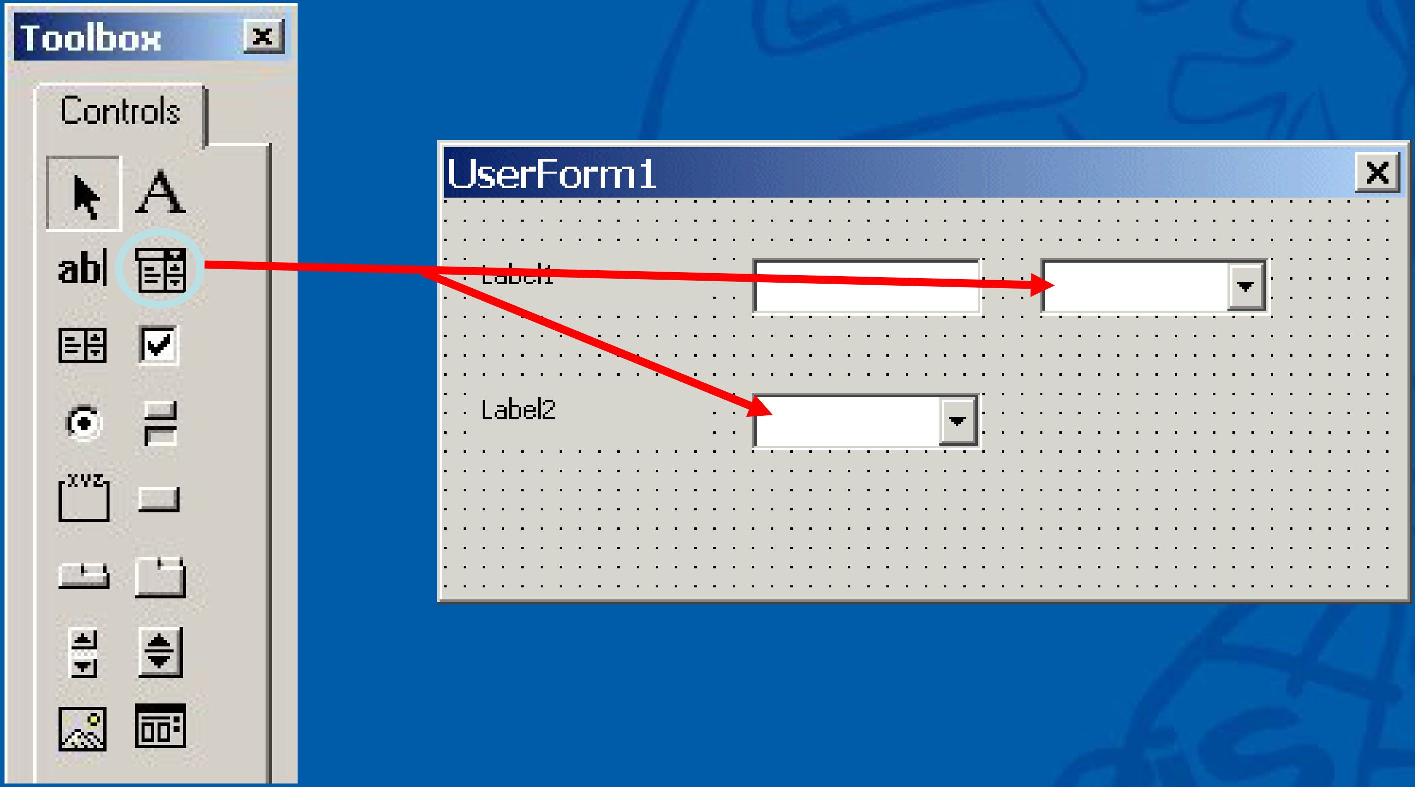

Placing Controls on the Form

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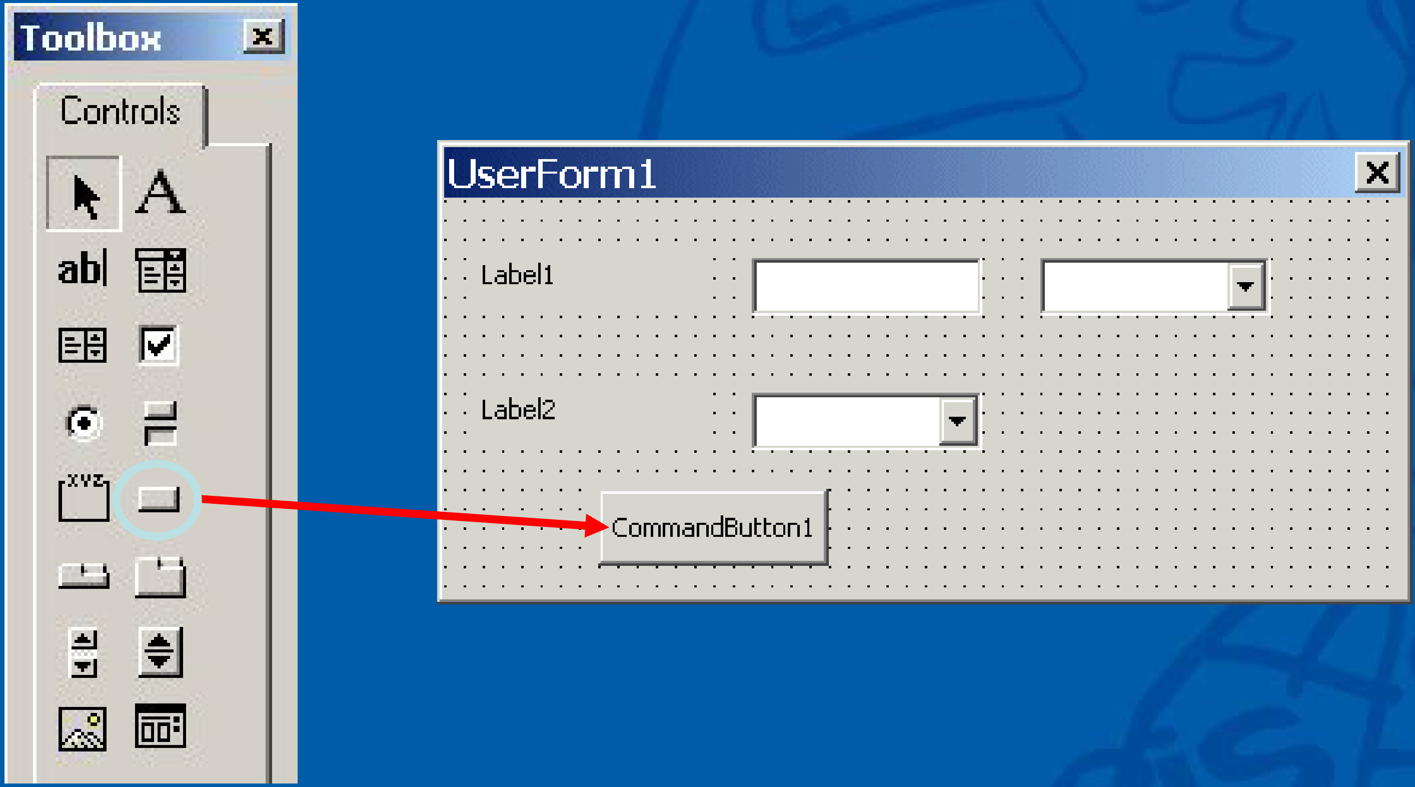
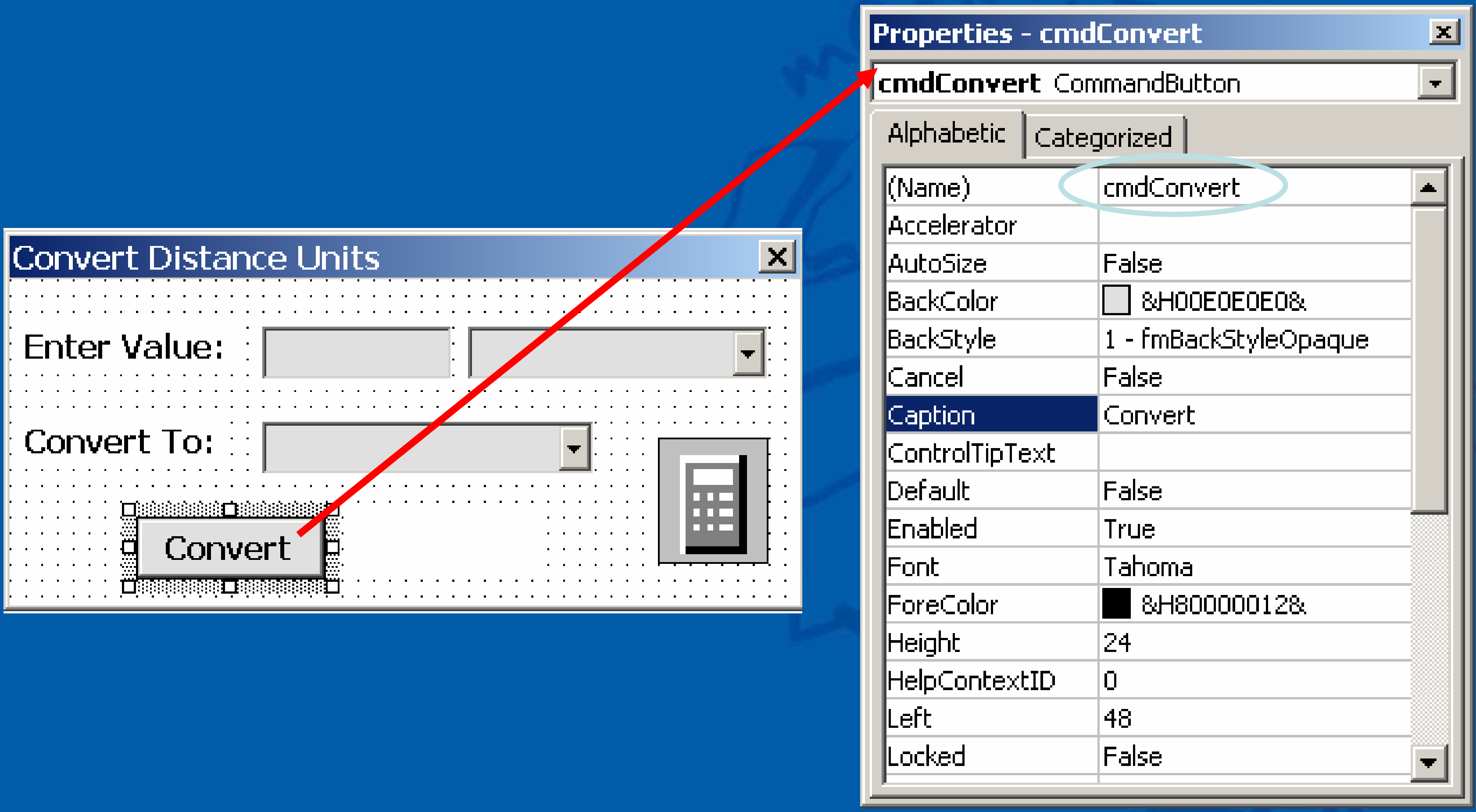
- Given default properties



Changing Properties



Properties - cmdConvert

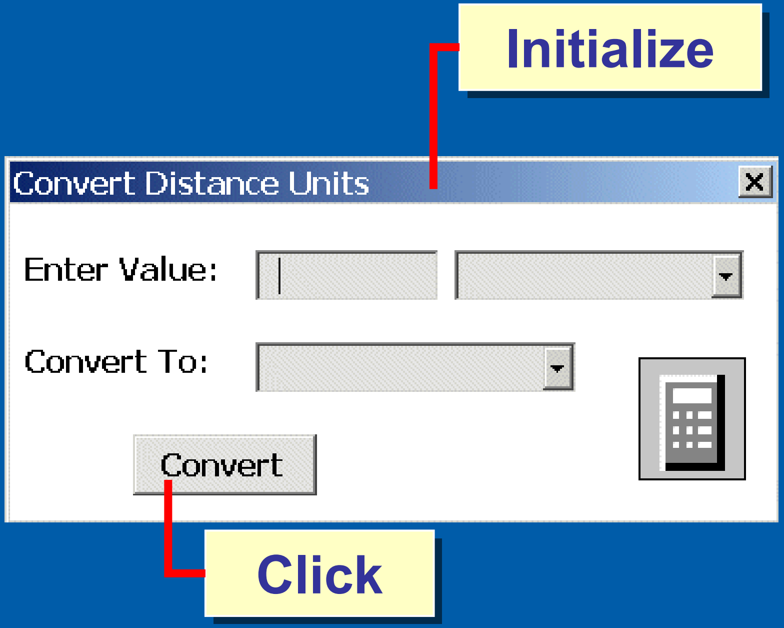
cmdConvert CommandButton

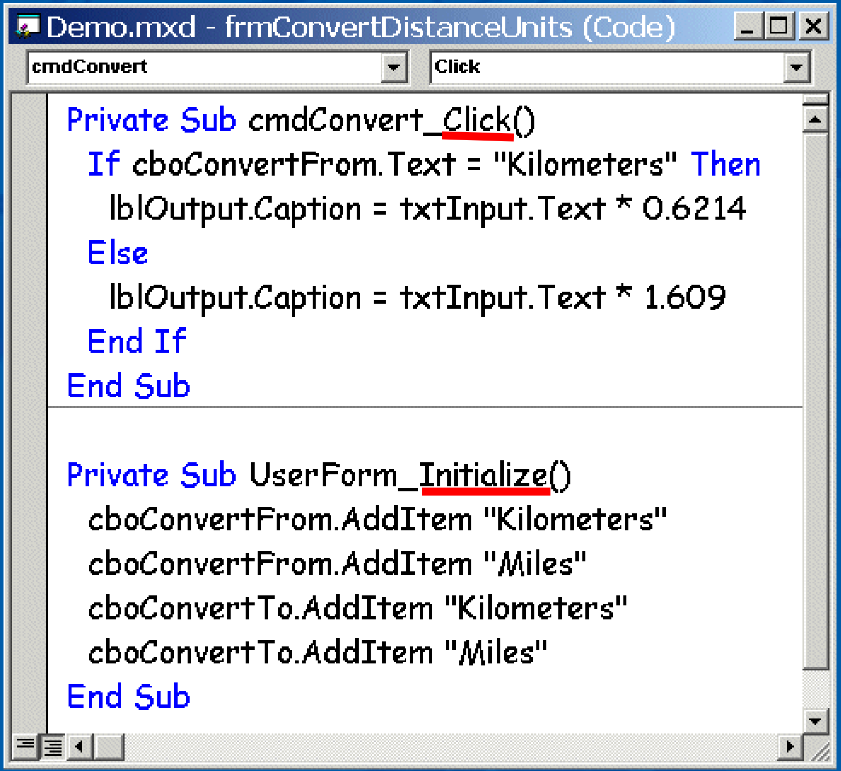
Alphabetic | Categorized

(Name)	cmdConvert
Accelerator	
AutoSize	False
BackColor	□ &H00E0E0E0&
BackStyle	1 - fmBackStyleOpaque
Cancel	False
Caption	Convert
ControlTipText	
Default	False
Enabled	True
Font	Tahoma
ForeColor	■ &H80000012&
Height	24
HelpContextID	0
Left	48
Locked	False

Writing the Code

- Tie code to the object event procedures
- Objects found on left, events on right



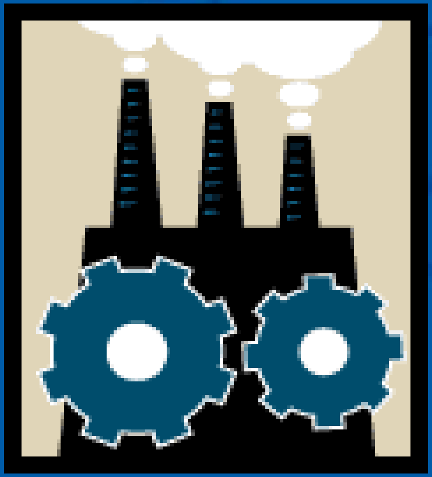


```
Private Sub cmdConvert_Click()
  If cboConvertFrom.Text = "Kilometers" Then
    lblOutput.Caption = txtInput.Text * 0.6214
  Else
    lblOutput.Caption = txtInput.Text * 1.609
  End If
End Sub

Private Sub UserForm_Initialize()
  cboConvertFrom.AddItem "Kilometers"
  cboConvertFrom.AddItem "Miles"
  cboConvertTo.AddItem "Kilometers"
  cboConvertTo.AddItem "Miles"
End Sub
```

Instructor Led Demo: Creating a Form

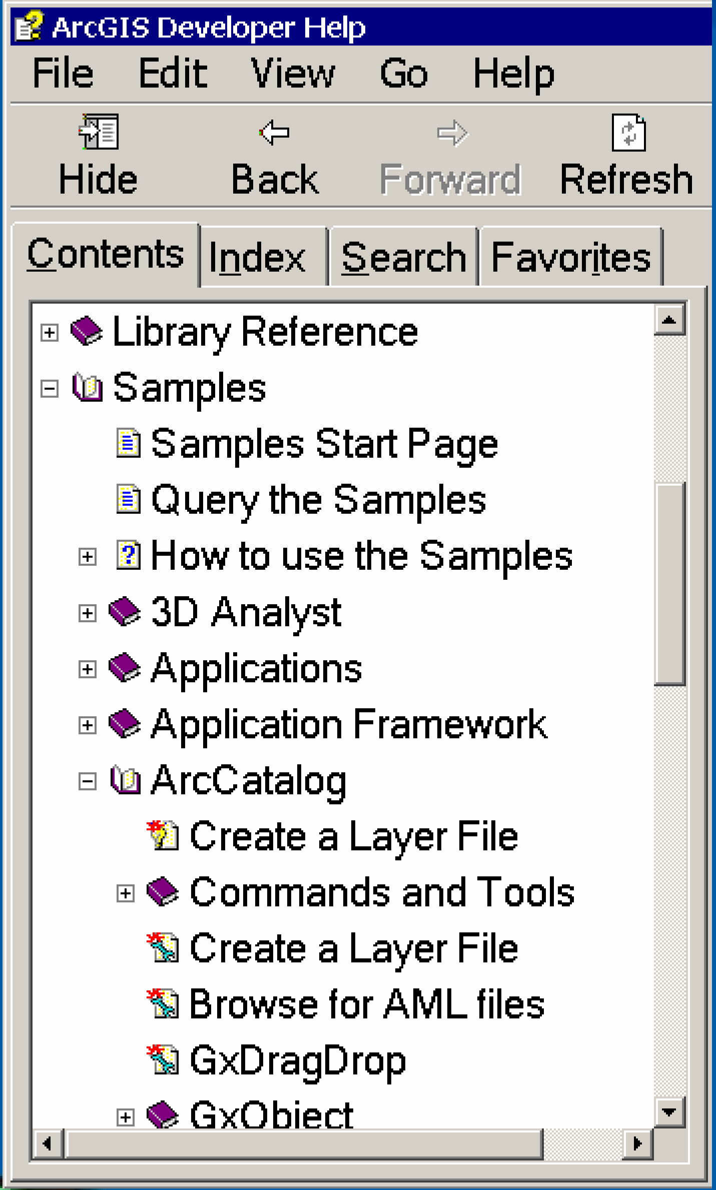
- Create a form
  - Convert Celsius to Fahrenheit
  - (txtCelsius.Text * 9 / 5) + 32
- Show form with a button



Workshop overview

- The VBA development environment
  - Customize dialog box
    - Changing the UI without writing code!
  - Visual Basic Editor
    - Where to write code
- Introductory look at ArcObjects
- Using developer samples

Finding Existing Code

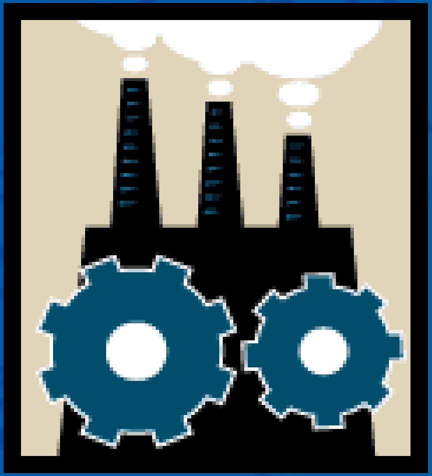


- Library Reference
- Samples
  - Samples Start Page
  - Query the Samples
  - How to use the Samples
  - 3D Analyst
  - Applications
  - Application Framework
  - ArcCatalog
    - Create a Layer File
    - Commands and Tools
    - Create a Layer File
    - Browse for AML files
    - GxDragDrop
    - GxObject

- Tips
  - Source code
  - Copy and paste into VBA
- Tools
  - Compiled code (.dll)
- Follow Instructions!

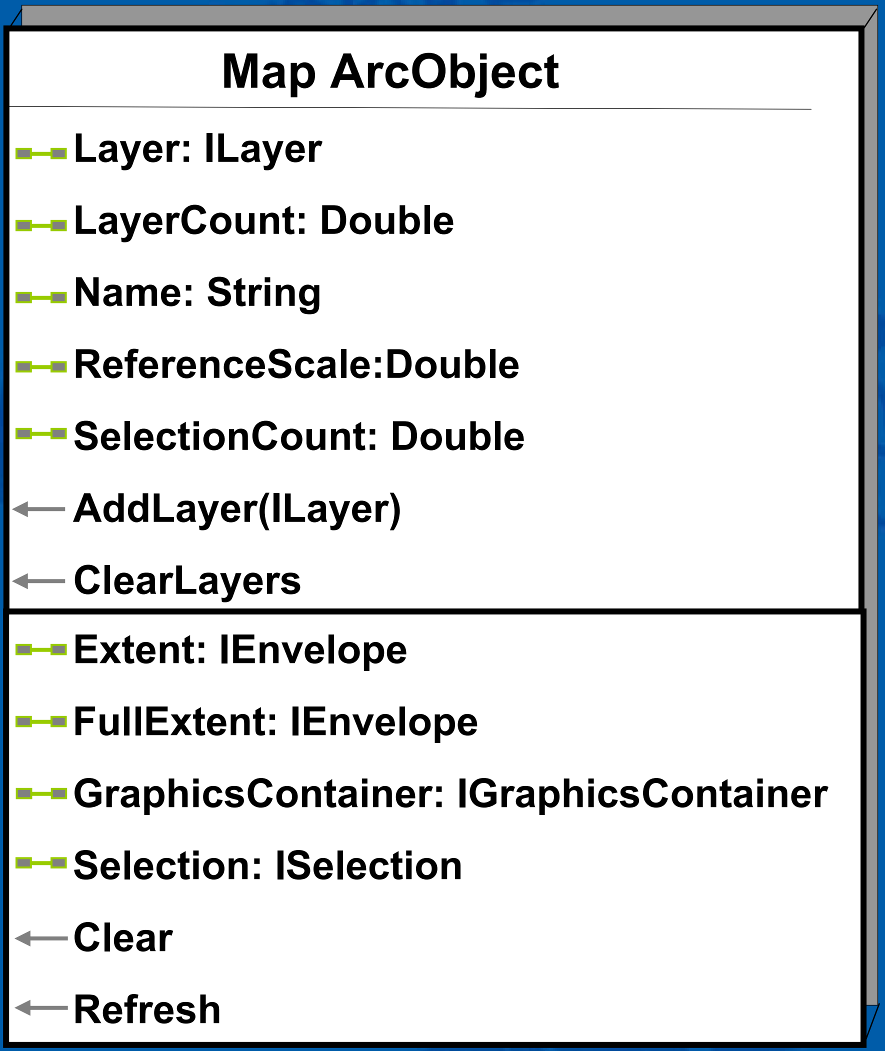
Demo: Using a developer sample

- Tip
  - Add a layer file to ArcMap
- EDN Online:
  - http://edn.esri.com



Object Oriented

- Object members:
  - •Properties (■—■)
  - •Methods (←)



Map ArcObject

■—■ **Layer: ILayer**

■—■ **LayerCount: Double**

■—■ **Name: String**

■—■ **ReferenceScale:Double**

■—■ **SelectionCount: Double**

← **AddLayer(ILayer)**

← **ClearLayers**

■—■ **Extent: IEnvelope**

■—■ **FullExtent: IEnvelope**

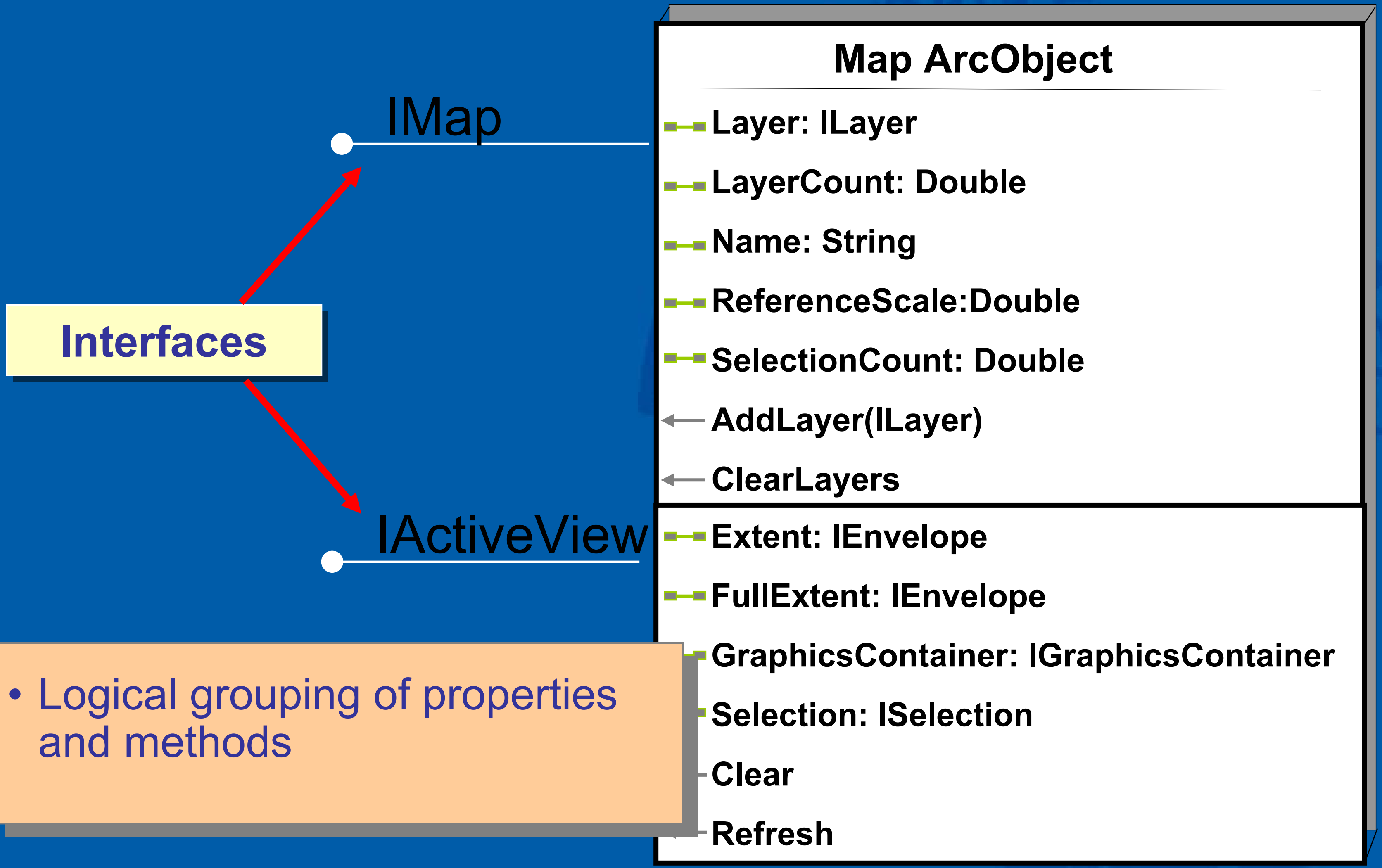
■—■ **GraphicsContainer: IGraphicsContainer**

■—■ **Selection: ISelection**

← **Clear**

← **Refresh**

Interfaces



Interfaces

IMap

IActiveView

Map ArcObject

Layer: ILayer

LayerCount: Double

Name: String

ReferenceScale:Double

SelectionCount: Double

AddLayer(ILayer)

ClearLayers

Extent: IEnvelope

FullExtent: IEnvelope

GraphicsContainer: IGraphicsContainer

Selection: ISelection

Clear

Refresh

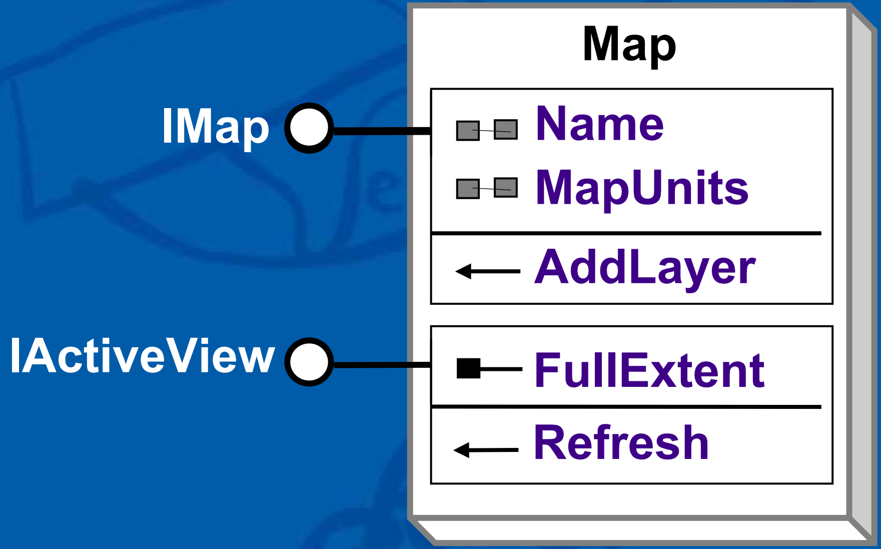
- Logical grouping of properties and methods

Interfaces

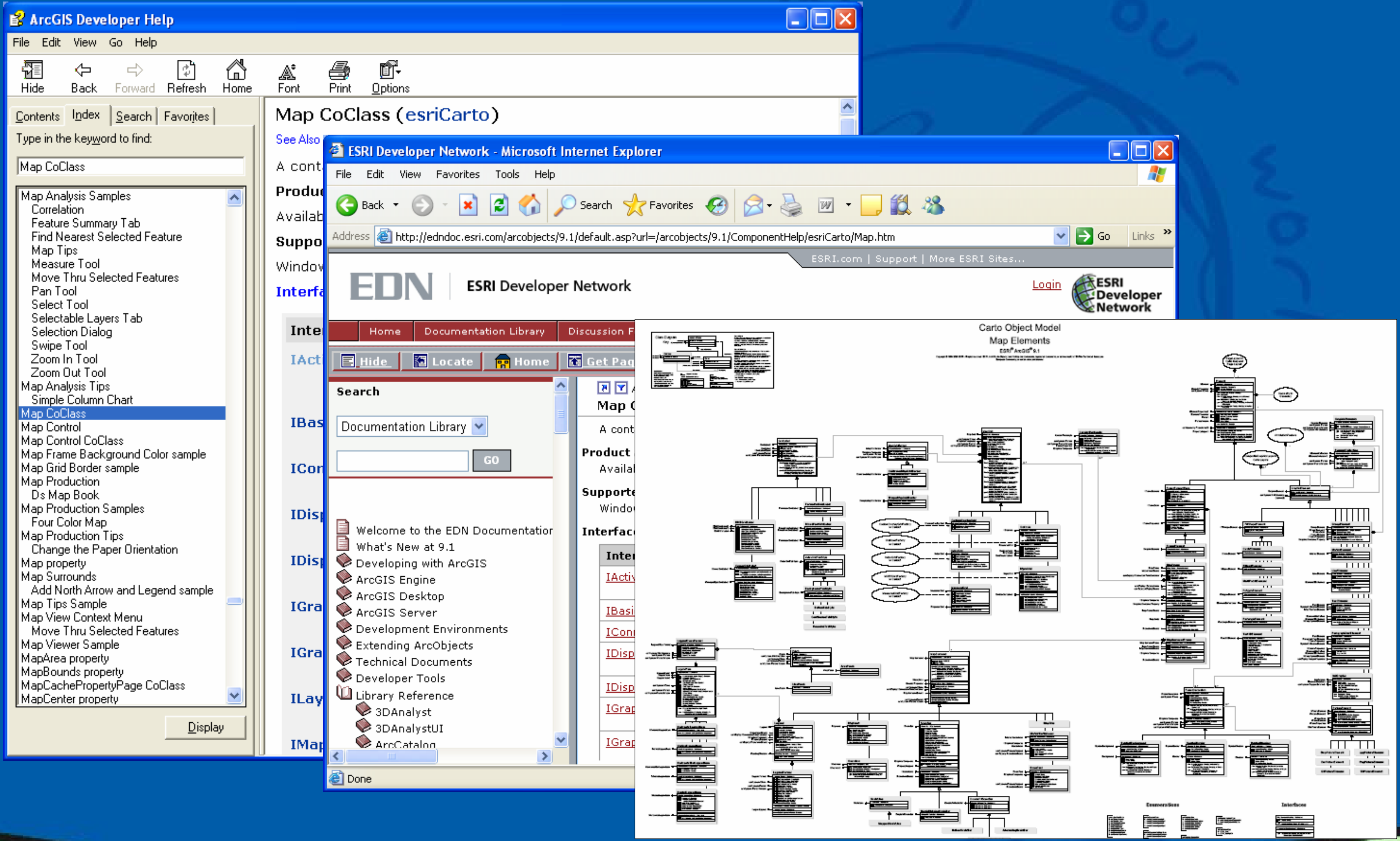
- Communicate with an object through its interface
- What interface will you use?
  - It depends on what property or method you want

```
Dim pMap As IMap
```

```
Dim pAV As IActiveView
```



Locating Interfaces



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Done

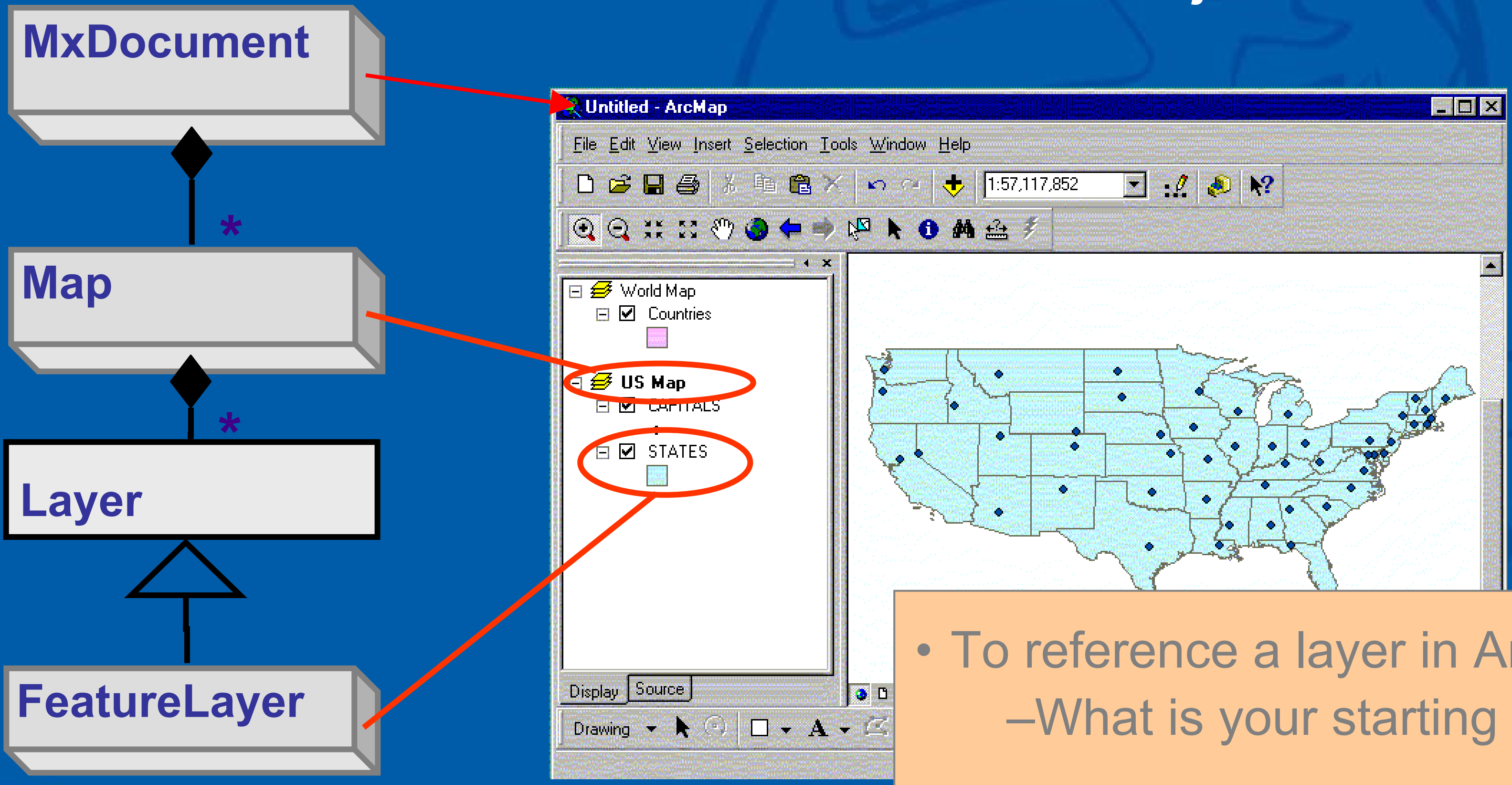
Carto Object Model

Map Elements

ESRI ArcGIS 9.1

Relationship between ArcObjects

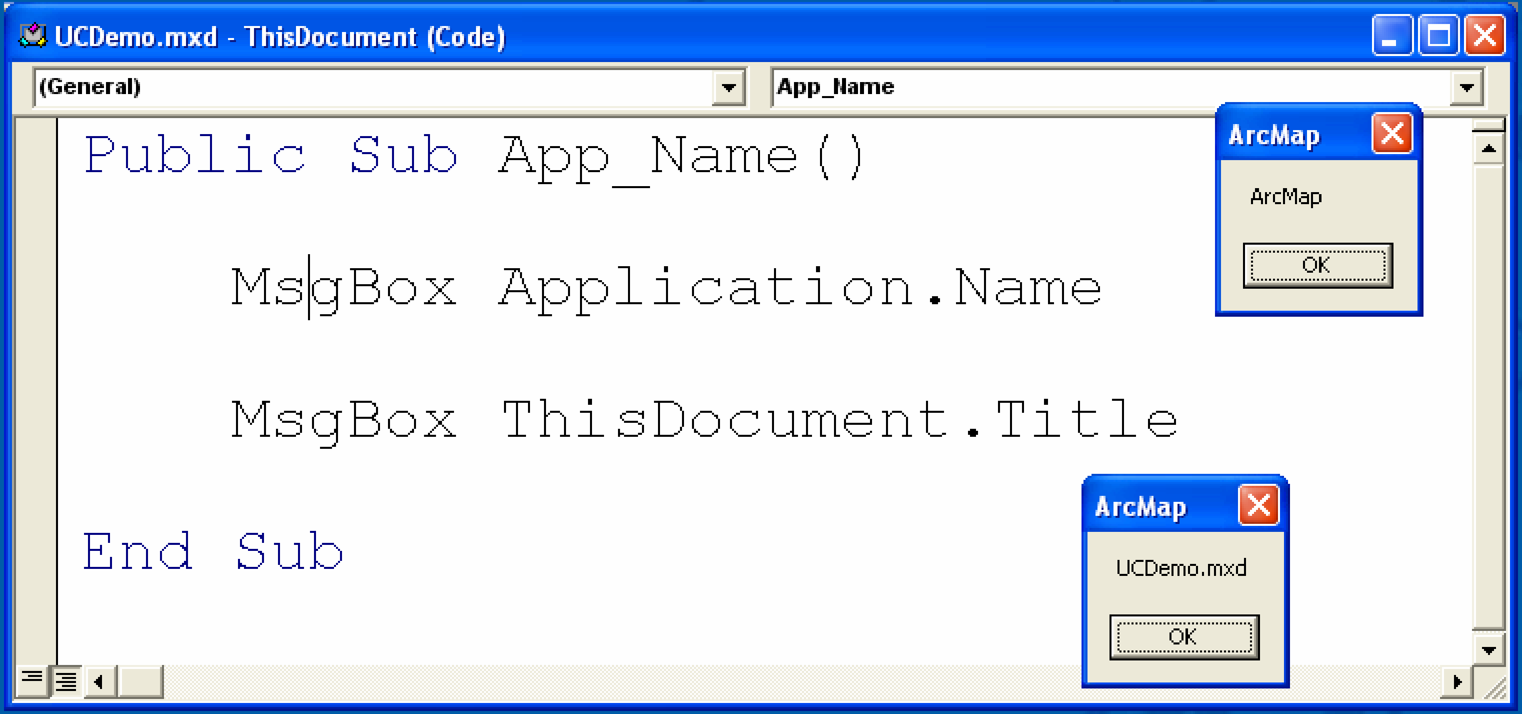
- To reference an existing ArcObjects
  - Can not reference it directly
  - Must think about where it resides in object model



- To reference a layer in ArcMap
  - –What is your starting point?

Starting points for writing code

- VBA offers two preset variables
  - *Application* references the ArcMap application
  - *ThisDocument* references the MxDocument



```
Public Sub App_Name()
    MsgBox Application.Name
    MsgBox ThisDocument.Title
End Sub
```

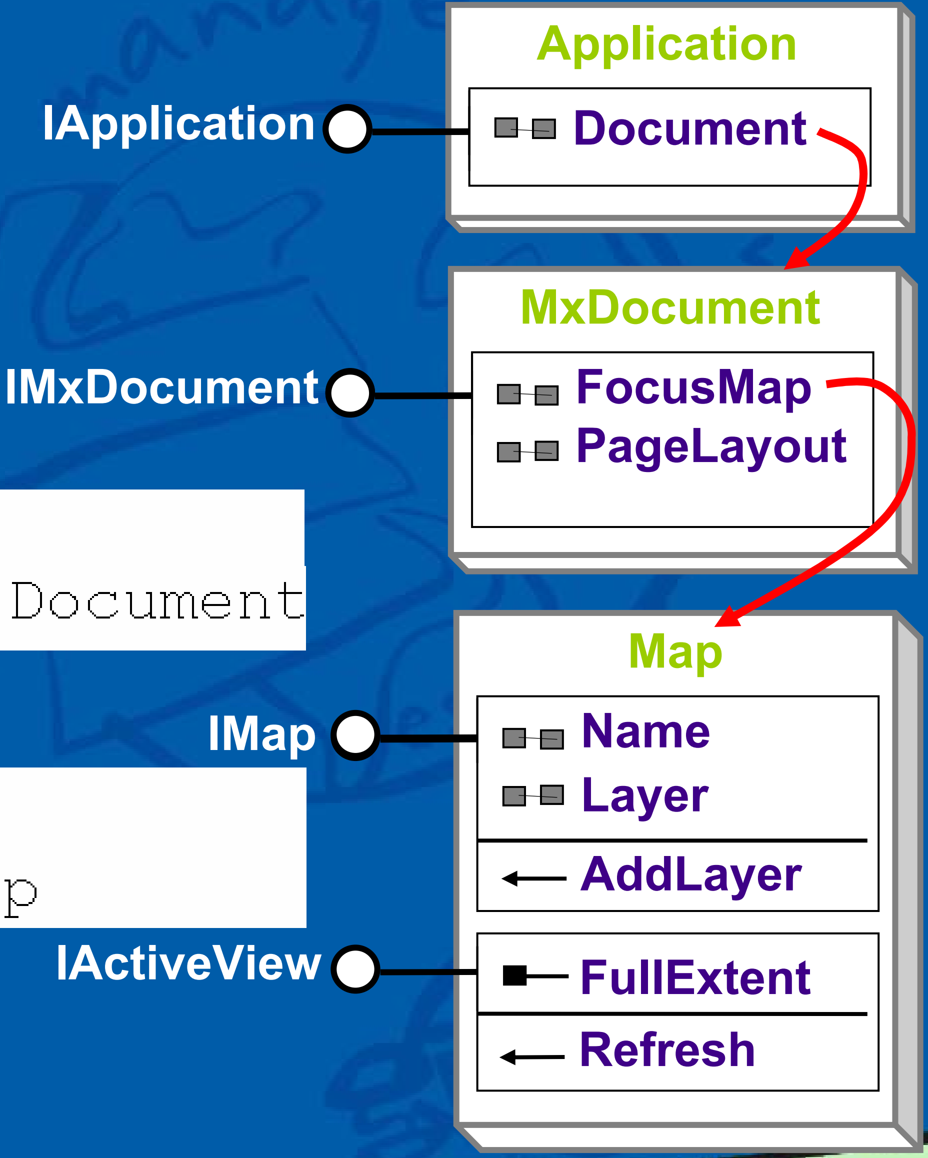
Two steps to writing ArcObjects code

Step One: Dimension

Step Two: Set

```
Dim pMxD As IMxDocument
Set pMxD = Application.Document
```

```
Dim pMap As IMap
Set pMap = pMxD.FocusMap
```

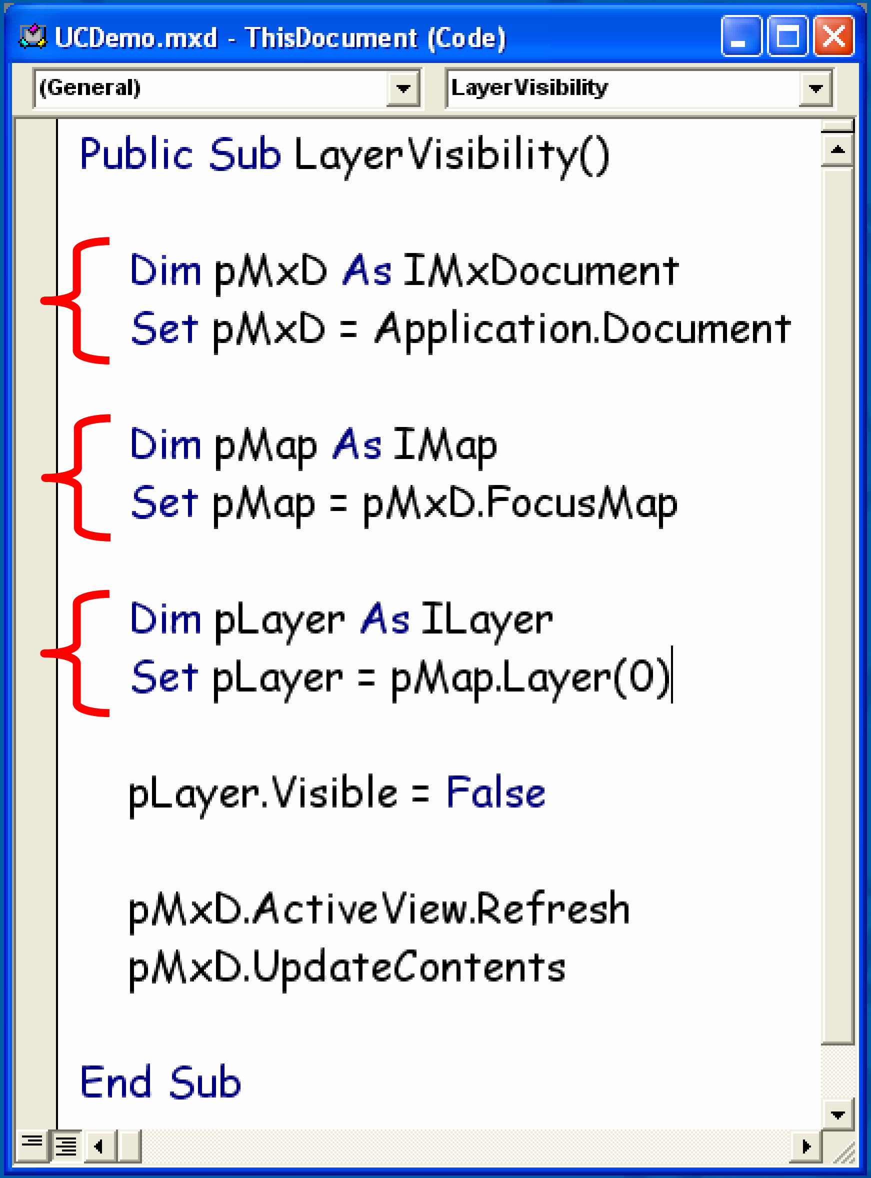


ArcObjects example

MxDocument

Map (Data Frame)

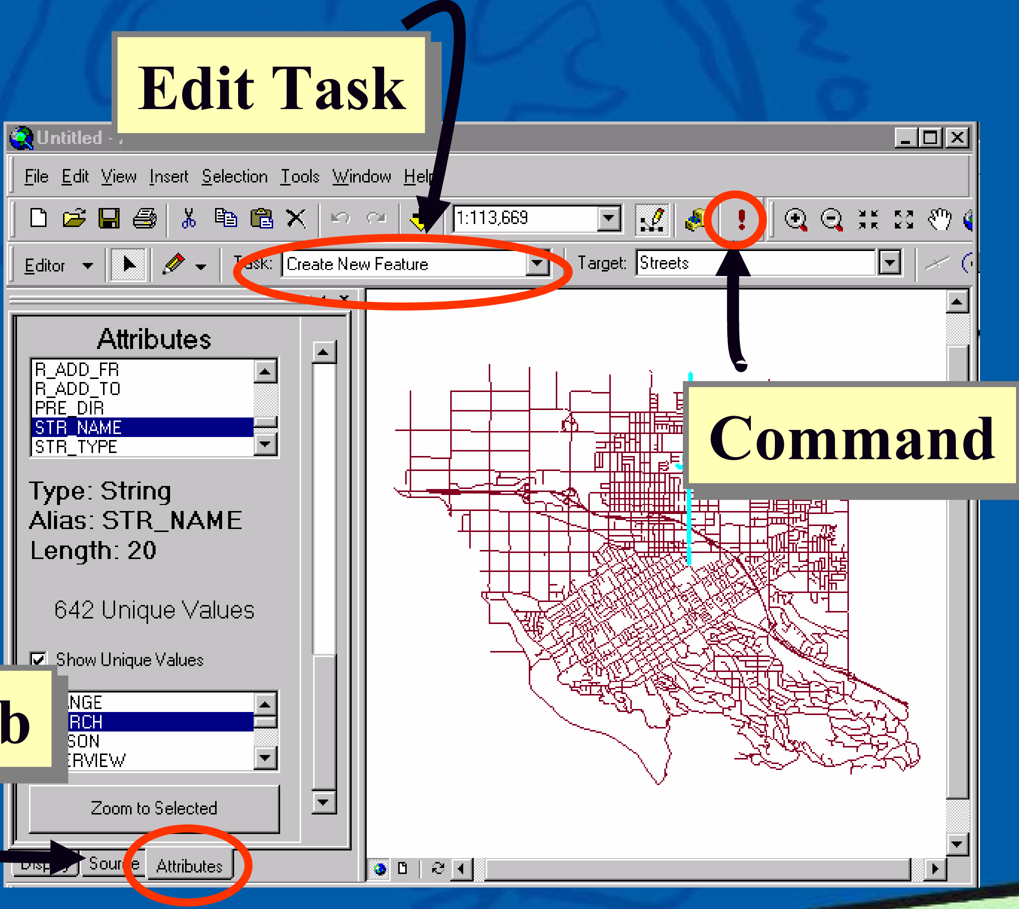
Layer



```
Public Sub LayerVisibility()

    Dim pMxD As IMxDocument
    Set pMxD = Application.Document

    Dim pMap As IMap
    Set pMap = pMxD.FocusMap

    Dim pLayer As ILayer
    Set pLayer = pMap.Layer(0)

    pLayer.Visible = False

    pMxD.ActiveView.Refresh
    pMxD.UpdateContents

End Sub
```

Advanced Desktop Customization

- Use VB6, VC++ or .NET to extend Desktop applications and geodatabase
- Create custom components to enhance functionality



1:113,669

Task: Create New Feature

Target: Streets

Attributes

R_ADD_FR
R_ADD_TO
PRE_DIR
STR_NAME
STR_TYPE

Type: String

Alias: STR_NAME

Length: 20

642 Unique Values

☑ Show Unique Values

NGE
RCH
SON
RVIEW

Edit Task

Command

Table of Contents Tab

Using a .DLL

- "Dynamic Linked Library"
- Save the .DLL onto your hard drive
- All samples already installed in:
  - C:\Program Files\ArcGIS\DeveloperKit\samples
- In the Customize Dialog box in ArcMap, choose “Add from file”
  - The .DLL will be added as a command under the “Developer Samples” category
  - Drag and Drop this command to any toolbar

Useful Resources

- ESRI Developer Network (EDN):
  - – http://edn.esri.com/
    - Documentation
    - Samples
    - Discussion forums
- Web based and instructor led training
  - – Introduction to Programming ArcObjects with VBA: 5-day instructor led course
- Book: Getting to Know ArcObjects